Metal Finishing

POLISHING AND BUFFING · BARREL FINISHING · CLEANING
PLATING · ANODIZING · RUST PROOFING · LACQUERING & ENAMELING

DECEMBER, 1957

CONTENTS:

Read and pass on—

Greetings

Again we greet you at this Holiday Season . . . .

To You whose Friendship and Good will we Cherish may we say Thank you and also wish you a real Merry Xmas and a bright and successful New Year.

FREDERICK GUMM

Chemical Company Inc.

538 FOREST STREET, KEARNY, N.J.

Here are 6 good methods for making easy jobs out of hard ones

1. For precleaning in the plating shop

Oakite precleaners quickly remove the toughest soils that work their way into the plating shop. This 44-page illustrated booklet gives useful information about tank precleaning on pages 6 to 11 and machine precleaning on pages 11 to 14.

2. For descaling and derusting steel

Oakite Rustripper saves time by removing heat scale and rust in the same operation that removes oil. Alkaline pickling with Rustripper avoids hydrogen embrittlement, etching of machined surfaces and other disadvantages of acid pickling.

3. For electrocleaning steel

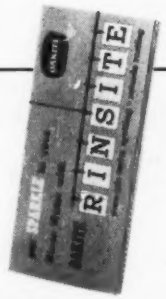
Oakite Composition No. 90 is a reverse-current cleaner with great ability to remove oils, smuts and other objectionable films that interfere with good electroplating. Solutions have high conductivity and long service life. Controlled foaming eliminates explosion hazards.

4. For electrocleaning brass

Oakite Composition No. 191 scientifically protects brass from the oxygen that tarnishes during the use of reverse current. Solutions have high conductivity, long life and high tolerance for chromic acid carried over by plating racks.

5. For electroconditioning zinc die castings

Oakite Composition No. 95 anodically removes all films that would impair the brightness of the plate. Under-surface shadows and anodic blackening are eliminated. A manufacturer of die-cast hardware reported "No. 95 cut our cleaning rejects more than 95%."



6. For preventing water spots

Oakite Rinsite causes rinse water to drain rapidly, leaving the plated metal bright, sparkling and completely free from water spots and tarnish. Rinsite is also good as a rust preventive in rinses between barrel finishing operations.

FREE

Write to Oakite Products, Inc., 18 Rector St., New York 6, N. Y., for the booklets (listed below) that interest you:

1. "Some good things to know about Metal Cleaning"
2. "Here's the best shortcut in the field of electroplating"
3. "Four good steps toward better electroplating on steel"
4. "What's NEW in electrocleaning brass and other copper alloys"
5. "Good news about electrocleaning zinc-base die castings"
6. "Put SPARKLE in your rinse water with Oakite Rinsite"

SPECIALIZED INDUSTRIAL CLEANING
OAKITE
MATERIALS · METHODS · SERVICE
SCIENCE

Technical Service Representatives in Principal Cities of U. S. and Canada

Export Division Cable Address: Oakite

4/Circle on Readers' Service Card

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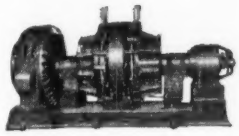
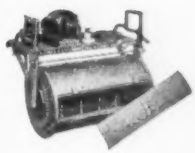
For 59 Years ...L'HOMMEDIEU...

year after year has manufactured Reliance Plating, Polishing Equipment, Supplies for Better and More Profitable Metal Finishing



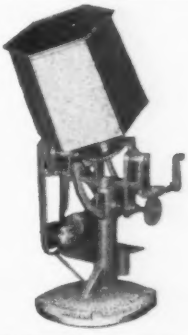
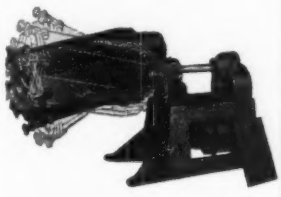

Season's Greetings

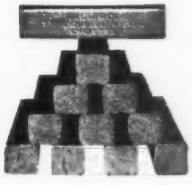
to

Our Customers

and

Friends


Chas. F. L'Hommedieu & Sons Co.

MANUFACTURERS OF METAL FINISHING EQUIPMENT AND SUPPLIES

GENERAL OFFICE AND FACTORY

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Detroit, Mich.

Branches:
Cleveland & Los Angeles

DU PONT PRODUCT NEWS

REG. U.S. PAT. OFF

New Du Pont cost-analysis method helps you save money two ways

• Du Pont's exclusive cost-analysis method can help you cut cleaning costs or help you choose the best cleaning process for your needs. This new service is now available at no cost or obligation. Check coupon for more details.

Du Pont and its distributors of Triclene® D trichlorethylene now offer an accurate method for analyzing all costs involved in metal cleaning. This new Du Pont service can save you money by helping you (1) determine where present cleaning costs can be cut, or (2) choose the most efficient cleaning process if you're expanding or planning a new installation.

Du Pont's exclusive cost-analysis method combines 25 years of metal-cleaning experience with proven cost-accounting procedures. The result is a simplified and thoroughly reliable way to compare all costs of various cleaning processes or of alternate methods of handling your present cleaning operation.

Du Pont's cost analysis gives you a *complete* cost picture and doesn't stop with the obvious, and usually misleading, cost factors such as equipment, solvent or chemicals. You'll be able to answer any question about your cleaning costs confidently and instantly spot those that are out of line.

Du Pont, or its distributors of "Triclene" D, will be glad to give you full details. Whether it's cutting costs, improving your present cleaning results or trying to decide which cleaning process is best for you—you can get accurate answers using Du Pont's proven cost-analysis method. Use the coupon for prompt attention.

• Conveyorized vapor-degreasing unit cleans oil, grease and chips from machined aircraft cylinders.

Why vapor degreasing with TRICLENE® D is ideal for assembly-line cleaning

It's fast —Vapor degreasing with "Triclene" D removes grease, oil, cutting compounds and other contaminants—usually in less than a minute!

It's thorough —Vapor degreasing with "Triclene" D leaves parts clean and dry—instantly ready for the next operation; never causes etching or staining—leaves no deposits of any kind.

It's versatile —Vapor degreasing with "Triclene" D will clean parts made of all common metals and alloys, in any size or shape.

It's economical —Vapor-degreasing equipment is compact and inexpensive to install. Parts come out dry, eliminating need for dryers —saves valuable floor space. You'll find that the superior cleaning action of "Triclene" D eliminates rejects, cuts downtime.

It's easy to operate —Anyone can do it. In fact, vapor degreasers can be run automatically. Du Pont will be glad to provide instructions for proper operation of your vapor degreasers if you wish.

▶ If you would like to know more about degreasing, or want to be sure you're getting the most efficient cleaning from your present degreaser, call your Du Pont "Triclene" D distributor. If needed, he can call in one of Du Pont's metal-cleaning experts. You can also contact any Du Pont district sales office or use the coupon at right.

FOR MODERN METAL CLEANING

Du Pont's combination of neutral stabilizers makes TRICLENE® D THE BEST BUY IN DEGREASING SOLVENTS

It's a proven fact that "Triclene" D trichlorethylene gives brighter, stain-free cleaning; keeps degreaser coils free of sludge, thus reducing costly downtime and maintenance problems from clean-outs. All of these advantages can be traced to the unique combination of *neutral* stabilizers present in today's "Triclene" D.

Developed by Du Pont research, these stabilizers guard against attack from any deteriorating influences that may be involved in cleaning today's common metals and alloys. As a result, acids—formed by metals such as aluminum, or by contaminants such as oil, grease and cutting compounds—have no harmful effect on "Triclene" D's cleaning action. You get more mileage from "Triclene" D . . . or, put another way, you need less solvent to do the cleaning job when it's "Triclene" D.

Here's another economy feature. The neutral stabilizers in "Triclene" D are locked in and can't escape during distillation. Result: "Triclene" D is just as good after distillation as it was when Du Pont shipped it to you.

Experience in hundreds of metalworking plants has proved that "Triclene" D is the best buy in degreasing solvents. If you would like to prove it in *your* degreasing operation, just call Du Pont, any distributor of "Triclene" D, or use the coupon below.

Your distributor of TRICLENE® D— *a good man to have on your team*

Take inventories, for example. Think how much more of a problem they would be if you couldn't just call your distributor and get whatever supplies you need, where and when you need them. This applies not only to "Triclene" D, but to all of the other products he stocks locally for your convenience. But just one call from you—sometimes at the last minute—and you get the materials you need to keep production lines rolling. This convenience extends to your bookkeeping, where a single invoice can cover all of the different products you order.

More important perhaps than any of these valuable services is your distributor's local interest in you and your company. As an active member in your community, he takes care to provide you with quality products and any technical service that may be needed. If a difficult metal-cleaning problem develops, for example, he can call to your aid one of Du Pont's technical men. And it doesn't have to be a problem—he'll be glad to bring in an expert just to talk over any new ideas or plans you may have for expansion. Such meetings can often save you time and money.

Your distributor of "Triclene" D is a storehouse of valuable information, too. Manufacturers of the many products he represents keep him posted on new developments. He is always glad to share his information and provide you with useful literature. Think about the number of ways your distributor of "Triclene" D can help you—then give him a call. You'll find he's a good man to have on your team.

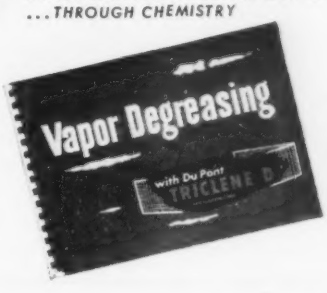
* * *

DID YOU KNOW 7 degreasers using "Triclene" D went two years without the need for a clean-out for a leading aircraft company? Striking proof of the stability, purity and dependability of this rugged solvent.

DU PONT
REG. U. S. PAT. OFF.

BETTER THINGS FOR BETTER LIVING
...THROUGH CHEMISTRY

FREE VAPOR-DEGREASING BOOKLET tells you how vapor degreasing works, shows types of equipment, points out many cost-saving advantages. Just mail the coupon below for your copy.



ELECTROCHEMICALS DEPARTMENT
Chlorine Products Division

E. I. DU PONT DE NEMOURS & CO. (INC.)
Wilmington 98, Delaware

☐ Please send more information on your new cost-analysis method. MF-12
☐ Please send me your booklet on vapor degreasing.
☐ Please have your representative call for an appointment.

*Name*_____ *Position*_____
*Present method of cleaning*_____
*Firm*_____
*Address*_____
*City*_____ *Zone*_____ *State*_____

DU PONT REG. U. S. PAT. OFF. *PRODUCT NEWS*

A new high-speed cyanide copper plating process

DU PONT is now offering a new copper process for plating steel parts and zinc die castings. This new bath has been thoroughly field-tested, and is producing high-quality results on automobile bumpers and grilles, hardware products and wire.

In addition to high-quality results, you get these other advantages with Du Pont's new high-speed copper-plating process:

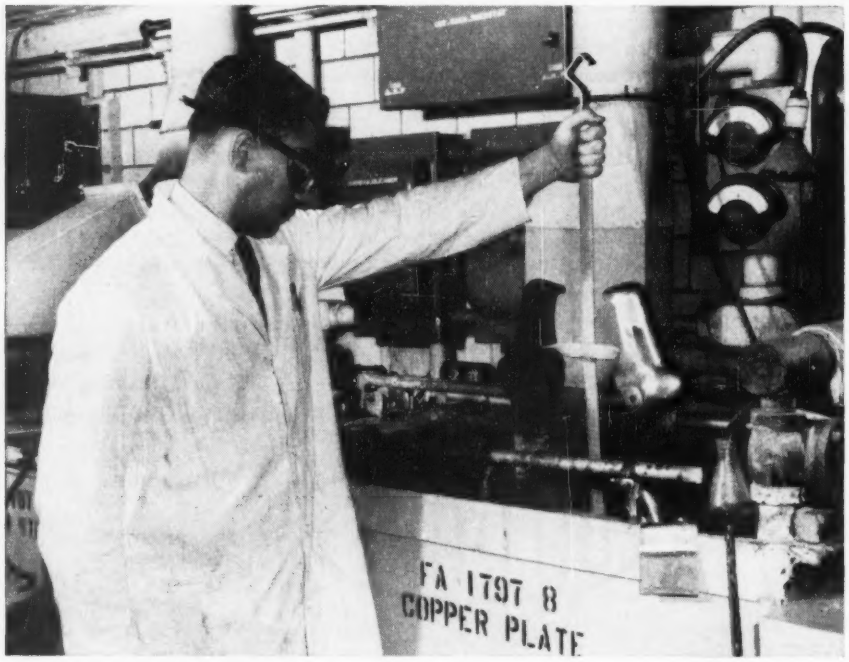
Low maintenance cost—An inexpensive cyanide electrolyte is used that is easily maintained with Cyanobrik® sodium cyanide or Du Pont high-purity potassium cyanide.

Simplicity—Only two new addition agents are needed. The first is Elchem 1396 which sequesters organic contamination and, by promoting smooth anode corrosion, assists in the production of smooth deposits. The other new addition agent—Elchem 1393—greatly increases the bright plating range of the bath and serves as a brightener.

Low use-cost of addition agents—means Du Pont's new Copper Plating Process is *economical* as well as effective.

Consistent, easily-controlled performance—Day-to-day performance is highly uniform—even after shutdowns. Use of the two addition agents—which are stable in the bath—contributes to this trouble-free operation.

Your existing high-efficiency copper bath can probably be converted to the new Du Pont plating process with minimum disturbance of production. For the complete story on this new high-quality copper-plating process, write or use the coupon on the next page.



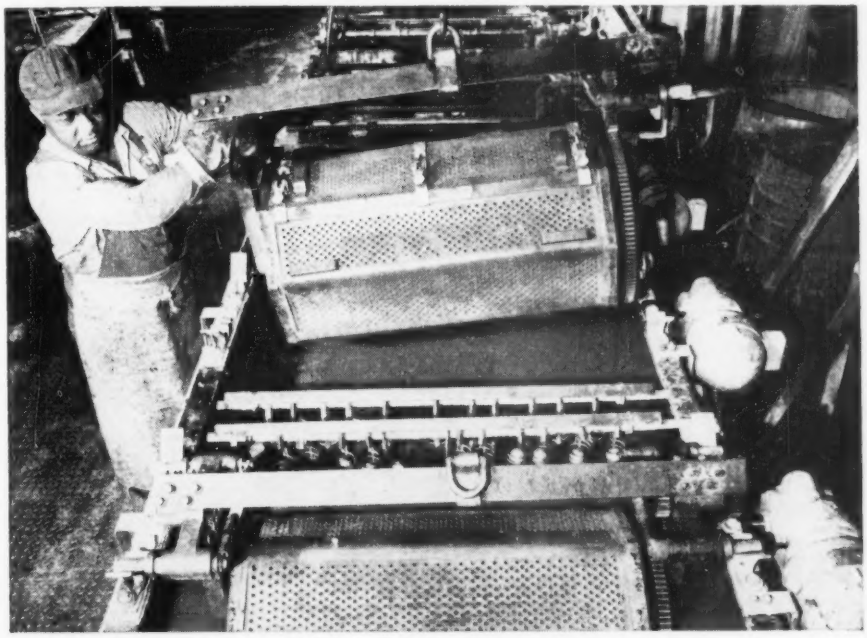
BRILLIANT COPPER-PLATED BUMPER GUARDS are removed from laboratory experimental bath. New Du Pont Process gives bright, smooth coatings at higher current densities.

A new plating chemical . . . sodium copper cyanide double salt . . . is manufactured by Du Pont specifically for make-up and maintenance of copper-plating solutions formulated with sodium cyanide. Advantages: facilitates make-up and replenishment of plating solution, cuts handling of chemicals, eliminates error in bath make-up and replenishment. Check and return coupon for more information.

DU PONT REG. U. S. PAT. OFF.

BETTER THINGS FOR BETTER LIVING
. . . THROUGH CHEMISTRY

FOR MODERN METAL PLATING



BARREL PLATING with Du Pont ZIN-O-LYTE. Brilliant deposits are obtained directly on parts of all sizes and shapes.

ZIN-O-LYTE® brightener special can cut zinc plating costs

No bright dipping required—because you get top-quality, brilliant blue-white zinc plating directly from the barrel with Du Pont "Zin-O-Lyte" Brightener Special. This new formulation is specifically designed to cut your operating costs at no sacrifice in quality.

Baths based on "Zin-O-Lyte" Brightener Special are easy to make up . . . economical to maintain . . . have good operating efficiency at both high and low current densities. Fully tested in production installations, "Zin-O-Lyte" Brightener Special is a readily soluble powder available in non-returnable Fiberpak drums. Like all "Zin-O-Lyte" zinc-plating chemicals, it is a highly uniform product giving consistently excellent results.

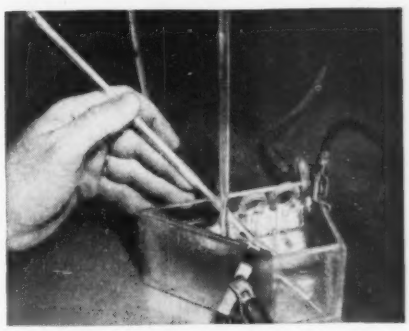
For further information about "Zin-O-Lyte" Brightener Special or any of the other plating chemicals in Du Pont's extensive line, just fill out and mail coupon below.

Du Pont will help you solve your plating problems

Du Pont's team of plating specialists is always available for help whenever you need it. Even if you have no serious problems, Du Pont will be glad to show you how to get the most for your plating dollar!

The Du Pont technical representative who calls on you can draw on years of trouble-shooting experience to help answer your plating questions. And he's backed by Du Pont's service and research labs. Here's where your plating problems can be studied and a detailed report prepared for your review.

Du Pont field men work closely with local Du Pont distributors. So whether you call Du Pont or any of their conveniently located distributors, you can count on fast action on all your plating needs.



Checking a plating solution in Hull Cell apparatus. Du Pont service and research facilities are always available for the benefit of platers using Du Pont's quality cyanides.

ELECTROCHEMICALS DEPARTMENT
Sodium Products Division

E. I. DU PONT DE NEMOURS & CO. (INC.)
Wilmington 98, Delaware

MF-12

Please send me information and literature on: ☐ New Copper Plating Process ☐ Zin-O-Lyte® brightener special ☐ Sodium copper cyanide double salt

*Name*_____ *Position*_____

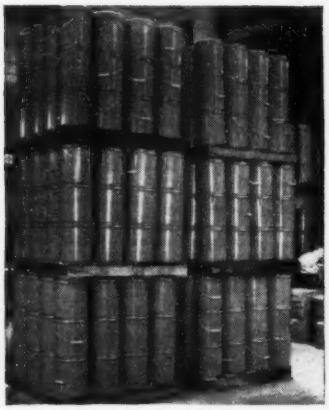
*Firm*_____

*Address*_____

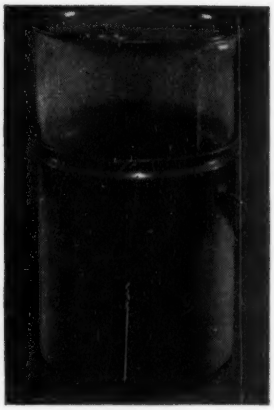
*City*_____ *Zone*_____ *State*_____

Greater convenience for you!

HARSHAW NOW SHIPS FLUOBORATES IN NON-RETURNABLE CONTAINERS



Convenient Stacking



Polyethylene Liner

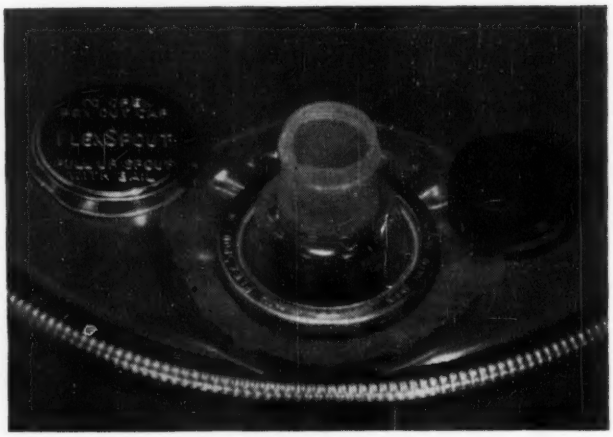
Harshaw's use of this 5-gallon polyethylene-lined steel pail brings important benefits to you:

YOU SAVE MONEY!

- No containers to return
- No records to keep
- No container deposit
- No return freight charges
- Less freight on incoming shipments

YOU SAVE WORK AND TIME!

- Light container—easy to handle even when full
- No special pouring equipment needed
- Built-in (pull out-push in) spout
- Specially designed for easy stacking



Pull Out-Push In Spout

These Harshaw fluoborate chemicals are now shipped in non-returnable containers:

Cadmium Fluoborate Solution
Copper Fluoborate Solution
Fluoboric Acid
Hydrofluosilicic Acid
Lead Fluoborate Solution
Nickel Fluoborate Solution
Tin Fluoborate Solution
Zinc Fluoborate

Enter your order today—the same high quality Harshaw fluoborates, and in a convenient new container.

THE HARSHAW CHEMICAL CO.

1945 E. 97th Street • Cleveland 6, Ohio

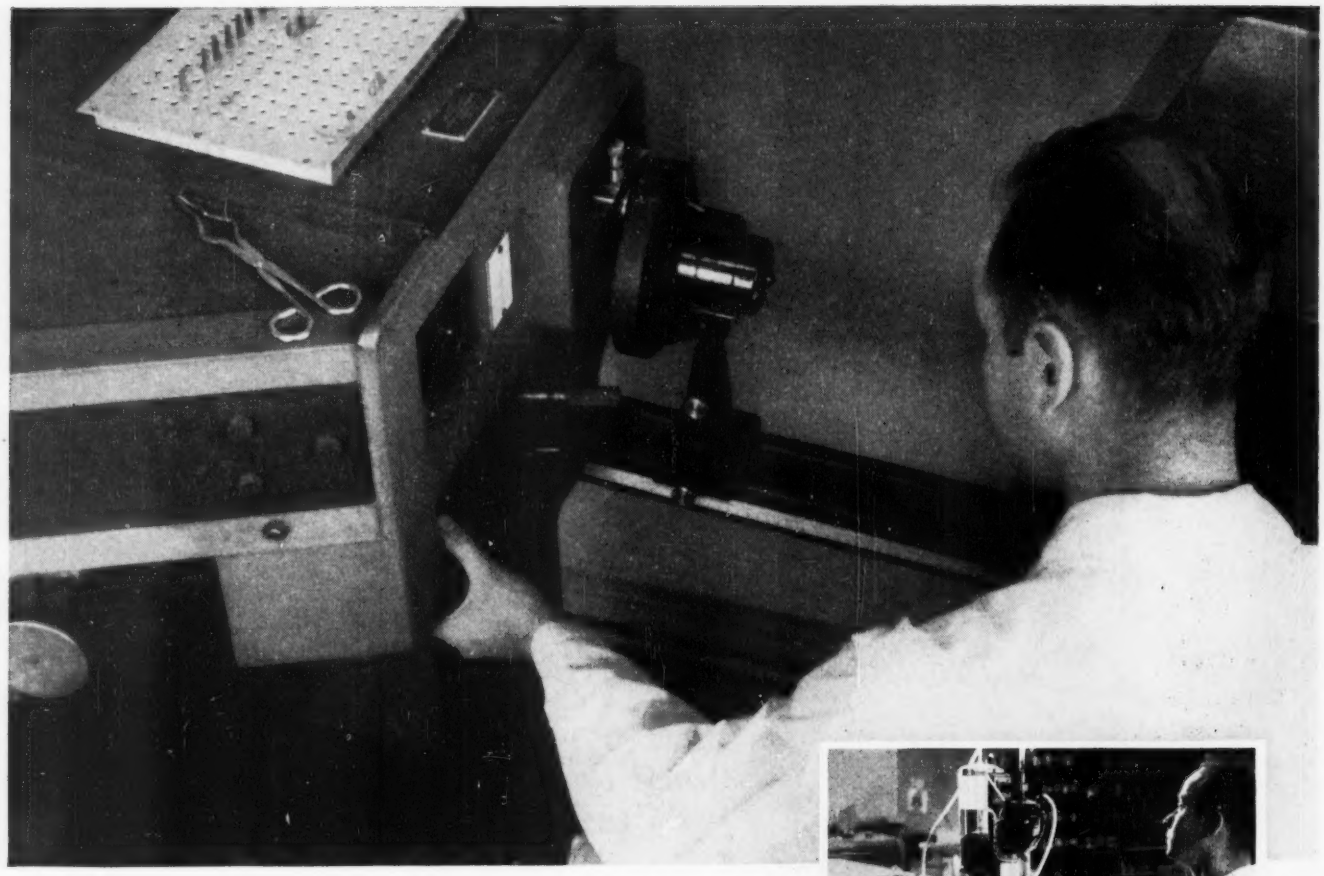
CHICAGO, ILLINOIS • CINCINNATI, OHIO • CLEVELAND, OHIO
DETROIT, MICH. • HOUSTON, TEXAS • LOS ANGELES, CALIF.
HASTINGS-ON-HUDSON, N.Y. • PHILADELPHIA, PENNSYLVANIA
PITTSBURGH, PENNSYLVANIA

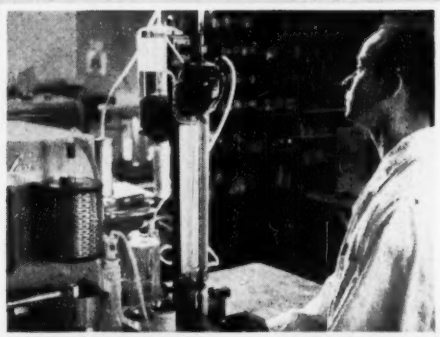

Season's Greetings

During this most joyous season
may we express our friendship
with our very best wishes for a

Merry Christmas
and a Happy New Year.
May the coming year bring
good health, prosperity and
continuing friendship.

RAPID ELECTRIC COMPANY



Illustrated are several views of our all new Wet and Spectrographic Laboratories, including some of the finest quality control equipment available.

"Al, you must be crazy . . ."

"A few years ago we decided to make our Quality Control Lab as good as could be found anywhere. We staffed it with first rate people and bought the latest in equipment including the finest Spectrographic Instrument available. At this point, our accountant — you know the type — a nice enough guy, but never happy unless he's shaking his head and wiggling his fingers at you . . . said to me, 'Al, you must be crazy, putting all this money into Quality Control.'

"Well, it took a lot of doing—and plenty of dollars, but it was worth it. We've grown steadily and it sure is a nice feeling to know that many of our regular customers include the finest platers in the country."

A. Kerzner

AL KERZNER, *President*

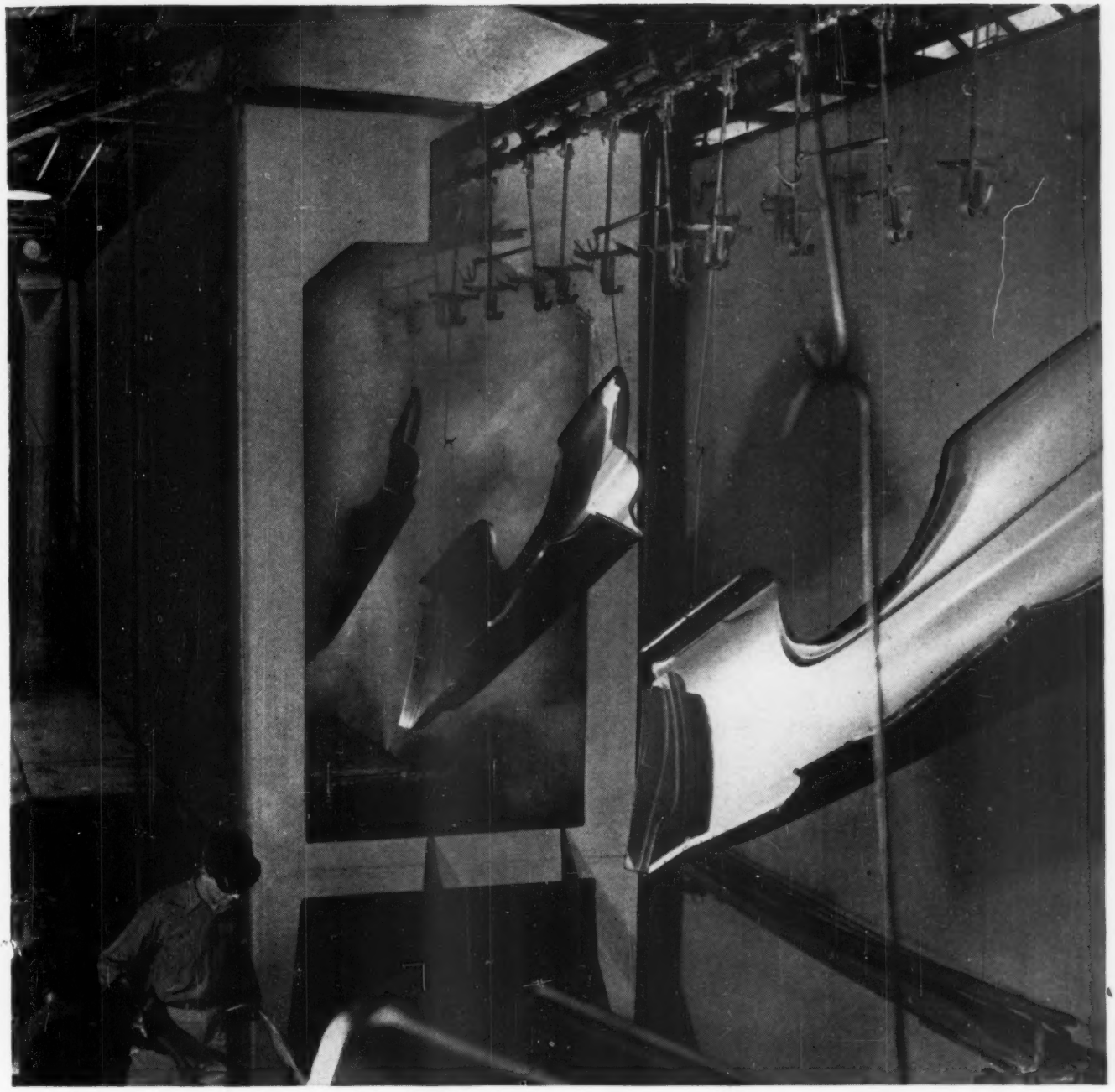
If you're a user of Copper, Nickel or Zinc Anodes, and if quality (at a competitive price) is an important factor to you, contact us! We manufacture them in a variety of sizes and shapes, and we can make them to your specifications.

NEW JERSEY METALS COMPANY

720 Rockefeller St., Elizabeth 2, N. J.

Serving Industry from Coast to Coast — since 1920

ELizabeth 4-6336



Experienced formulators know metal cleaners containing Dow Alkali do top job

Does the formulator of your cleaning compounds use Dow Alkali? Many plants, large and small, have cut costs substantially by switching to formulations containing Dow Sodium Orthosilicate or Dow Caustic Soda.

Experienced users of metal cleaning compounds prefer formulations made with Dow Alkali for spray cleaning, soak cleaning and electrolytic cleaning. That's an important fact for anyone who cleans metal parts to keep in mind. The reason is simply that experienced users are in the best position to judge the effectiveness and economy of the cleaning materials they use.

Their years of experience have proved to them that formulations made with Dow Alkali *consistently* give them the best results in terms of faster, more thorough cleaning and with fewer parts rejected—because Dow Alkali delivers the most effective cleaning power money can buy! THE DOW CHEMICAL COMPANY, Midland, Michigan, Department AL 610K-2.

YOU CAN DEPEND ON DOW

New Small Rod Agitator variable speed

The handy money-saving answer for plating printed circuits, costume jewelry, precious metals and small lot work of all kinds.

For cathode rods ¾" diameter or smaller.

Has 3" stroke. Speed adjustment from 12 to 29 strokes per minute.

Equipped with operating cord and plug for 115 V, 60 C, single phase.

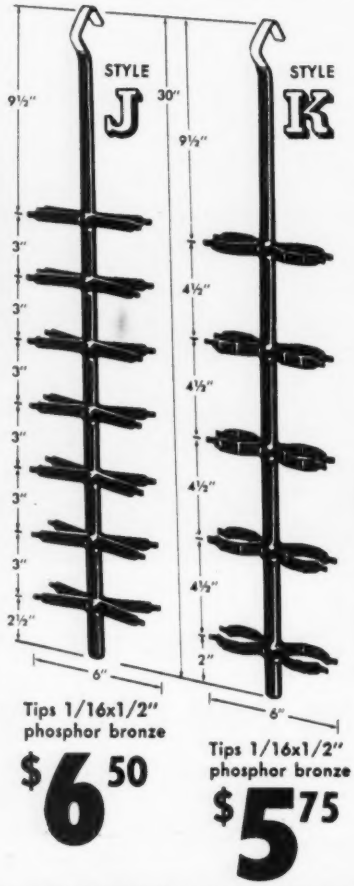
Furnished complete with tank or for installation on tank you have.

only **$99.50**

New Economy Racks

Answering the demands of hundreds of platers.

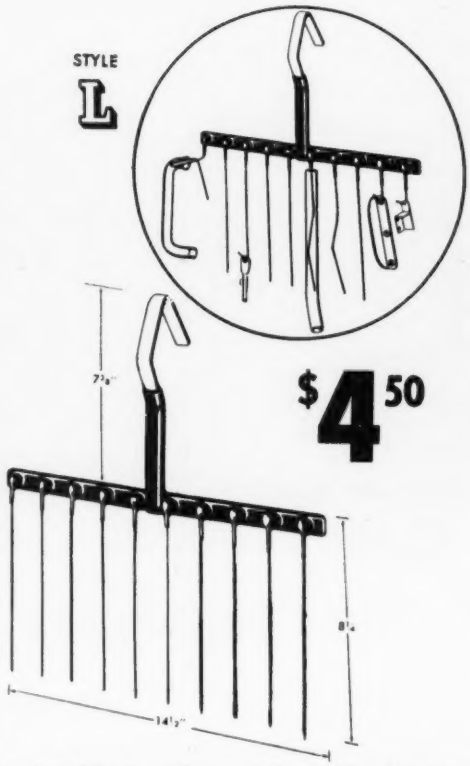
BELKE Economy Racks are available in 36" as well as 30" lengths.



Tips 1/16x1/2" phosphor bronze **$6.50**

Tips 1/16x1/2" phosphor bronze **$5.75**

STYLE L



$4.50

Furnished with straight .093 diameter phosphor bronze wires, 8" long, 1½ centers. Wires are easily shaped or shortened.

New Insulated "S" Hooks

Big time savers on 1000s of jobs.

Heavy Plastisol coating.

¼" copper rod.

Less than 100, $.45

100 or more, .40

also available in ⅛" copper rod.

STYLE M

SPINES are solid copper, round cornered and sand-blasted

Belke MANUFACTURING COMPANY

947 Cicero Ave., Chicago 51, Ill.

EVERYTHING FOR PLATING PLANTS

This electric-iron aluminum sole plate is being polished by an "81-Coat" Resinall Metalite Belt, grit 24X. Fir ishing time has been slashed and belt life greatly extended since these new Behr-Manning belts went on the jol

New "SPUR-ACTION" abrasive belt cuts faster, *outlasts all others by as much as 50%*

New "81-Coat" abrasive belts and discs have hundreds of sharper, tougher "spur" points per square inch for fastest stock removal...for greater resistance to grinding heat, the strongest resin bond yet. Test them yourself. Write for a demonstration of "81-Coat" abrasives on your toughest job—at your plant or at our nearest Branch Methods Room. You'll see how you can spur more production, more mileage per belt—*and at no increase in price!*

BEHR-MANNING CO.

TROY, N. Y.

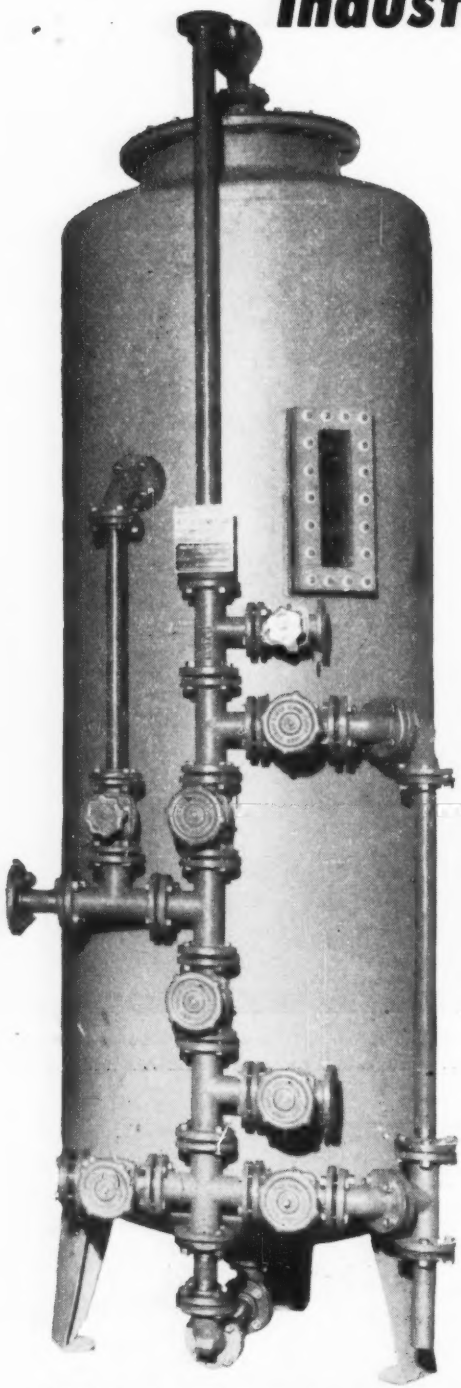
A DIVISION OF NORTON COMPANY NORTON ABRASIVES

BEHR-MANNING PRODUCTS: Coated Abrasives • Sharpening Stones • Pressure-Sensitive Tapes
NORTON PRODUCTS: Abrasives • Grinding Wheels • Grinding Machines • Refractories
In Canada: Behr-Manning (Canada) Ltd., Brantford. For Export: Norton Behr-Manning Overseas Inc., Troy, N. Y., U.S.A.

BEHR-MANNING®

Bright-dipping Aluminum?

Industrial can save you money!

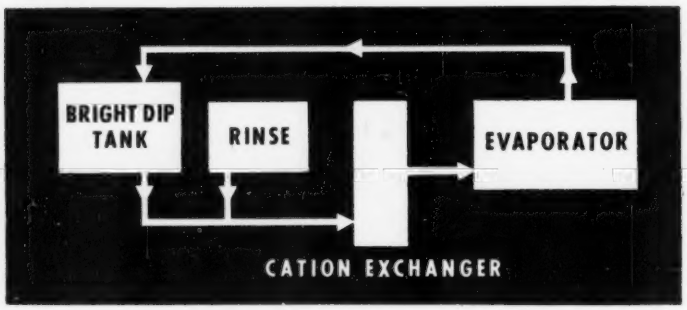


A typical cation exchange unit

New system recovers acid and keeps dip solution at peak efficiency

You can end the periodic replacement of expensive solution and continuously recover acid lost by dragout. These savings alone will pay for the equipment in about 18 months . . . and you can add to your profits by eliminating the cost of waste treatment and the maintenance and inspection of solutions necessary to keep contaminants at a low level. You can have fewer rejects and gain all the benefits of a process running at its highest efficiency.

How it works—A portion of the bright-dip solution is drawn off and diluted with the water rinse, making it possible to purify the dip and recover the dragout at the same time. The mixture passes through an Ion Exchanger where contaminants are removed and is then concentrated back to full strength in an evaporator. Industrial systems provide either continuous or intermittent flow.



A TYPICAL INDUSTRIAL SYSTEM

Insures uniform high quality production—By keeping your chemical polishing bath constantly at its best operating level you can greatly reduce the pitting and spotting on finished work caused by contaminants. An Industrial System will not only save acid and operating costs, it will simplify and speed up your entire bright-dip operation.

If you are looking for ways to lower production costs, an Industrial Recovery System is a very good buy indeed . . . **For full details write or call Industrial now** . . . we will be glad to make analyses and recommendations at no cost.

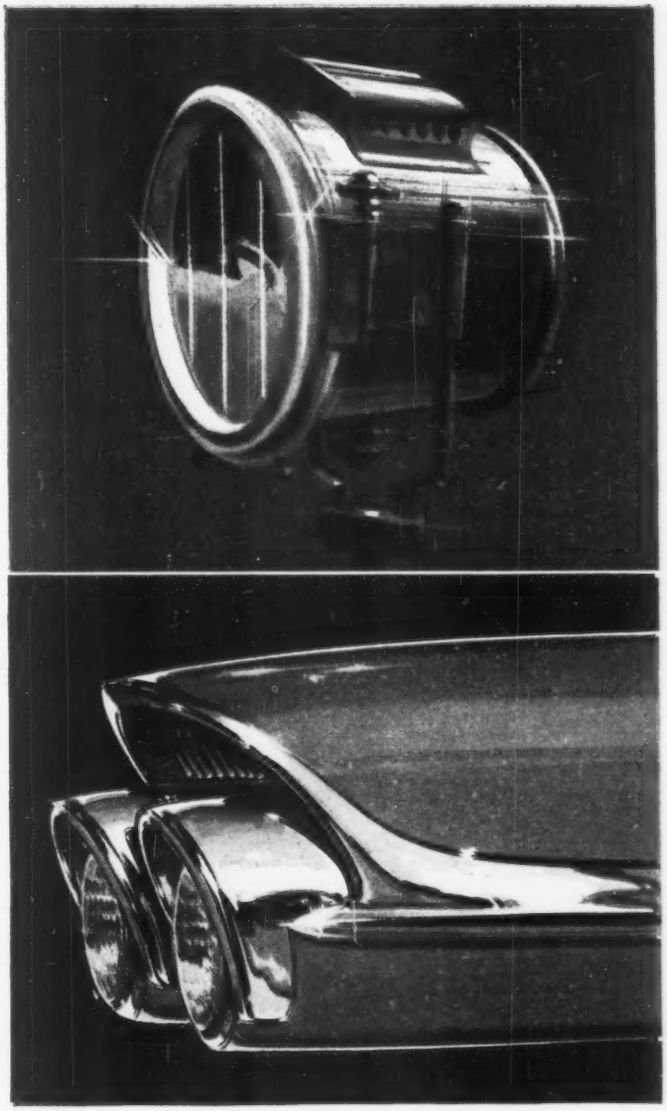
Phone Bishop 2-1180

Write for Technical Report 223.1

INDUSTRIAL

INDUSTRIAL FILTER & PUMP MFG. CO.
5906 OGDEN AVENUE • CHICAGO 50, ILLINOIS

Since the days of the oil and acetylene headlamp



Even back in 1910, part of an owner's pride in his car lay in gleaming brightwork. But polishing and buffing the shiny metal that he loved so well caused manufacturers plenty of headaches. And so they turned to Acme — and Acme has continued to supply the answers to their finishing problems.

Reduction of rejects, increased production volume, machine finishing of odd-shaped pieces . . . these are a few of the solutions Acme engineers have provided through the years.

Today Acme progressive engineering creates equipment that does a better, faster job than ever. And at low cost, too, because Acme engineers combine standard units with a wide variety of accessories to make *custom* buffing and polishing machines.

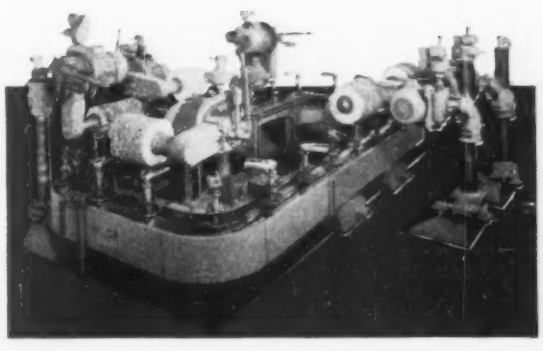
Every year of its history, Acme has encountered new finishing requirements—each an individual problem—and solved them. We can solve *your* problem, too.

ACME MANUFACTURING COMPANY

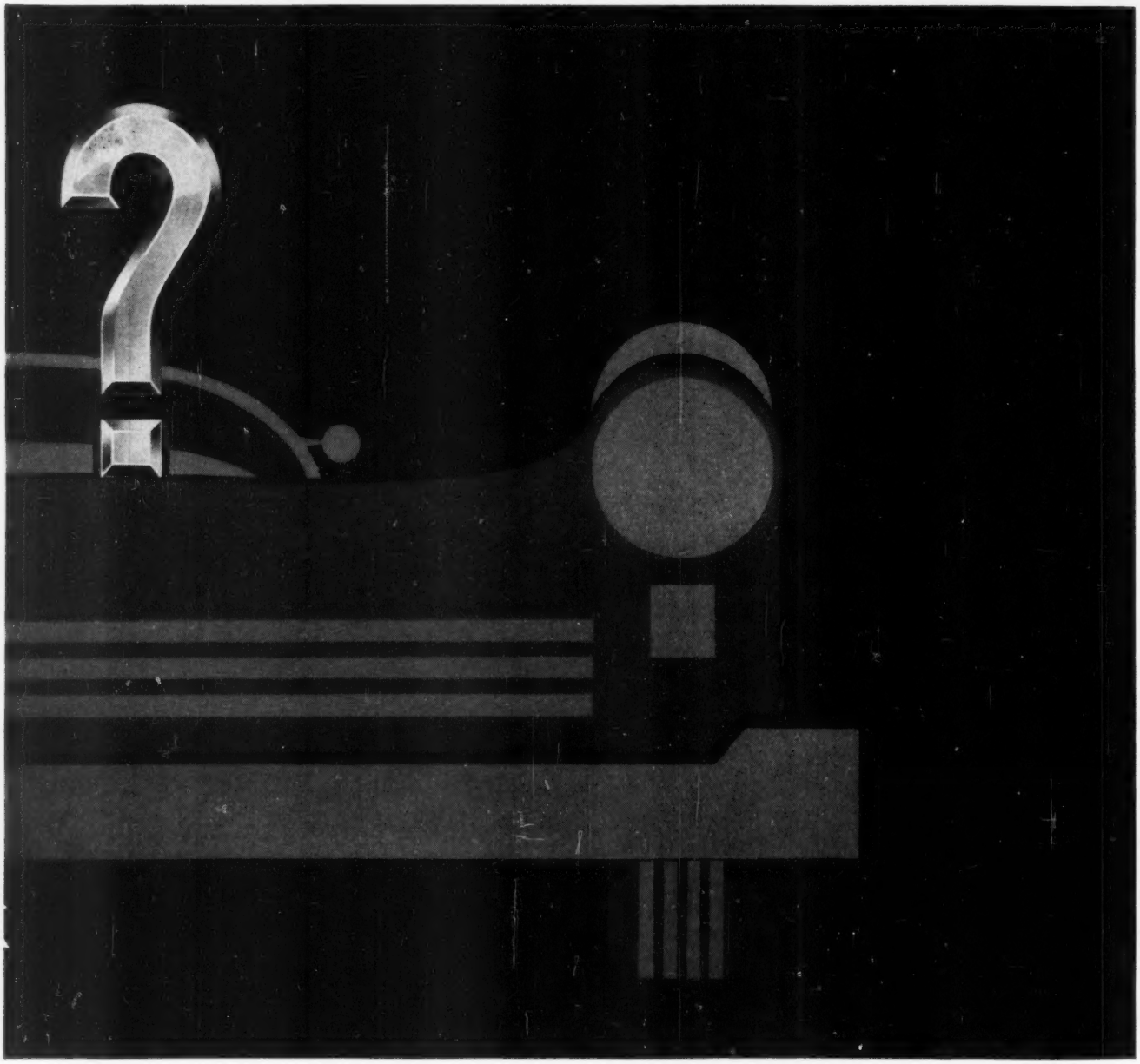
1400 E. 9 MILE ROAD, DETROIT 20, MICHIGAN

LEADING PRODUCERS OF AUTOMATIC POLISHING AND BUFFING EQUIPMENT SINCE 1910

Acme universal automatic polishing and buffing machine with camming and rotating fixture arrangement serving eight Acme adjustable heavy-duty buffing lathes having 24" wide wheels. Automatic wheel wear compensation is featured. Operation is finishing automotive taillight component.



LET ACME *Polish Off* YOUR FINISHING PROBLEMS



Grill Diamond's service department on chrome plating

Call in DIAMOND technical specialists when you run into a chrome-plating problem. These experienced men work only on customers' questions. They deliver complete, profit-making answers. Their service is free.

In making chromic acid, DIAMOND controls quality through every step. DIAMOND experience begins with importing the chrome ore and making the soda ash. It includes production and delivery . . . even standing by your side, if you wish, to help you get top-quality plating results at low cost.

DIAMOND facilities—two chromic acid plants and nine warehouses and sales offices across the country—assure you uninterrupted service from a dependable source of supply. DIAMOND ALKALI COMPANY, 300 Union Commerce Building, Cleveland 14, Ohio.

Diamond Chemicals

That's Me!

A Timely Message on **Therapeutic Leisure for Dogs**

(especially German Shepherds)

by Sox von Liebestraum Sax
Ex Detroit Rep. and Assistant to
Ben P. Sax, Chairman of the Board
American Buff Company

All work and no play makes "Sox" a very dull dog, German Shepherd or not. Of course, I don't have as much time for recreation as I used to before I started running American Buff Company single pawed.

For this reason, therapeutic use of leisure time is quite vital to me. And there is nothing that irritates me more than some of the snide tricks humans try to pull on us dogs.

For example, a few years back it was my custom to play chess with American Buffs as chessmen. One day, my father, Stan Sax, our Sales Master, tried to substitute some other buffs. Naturally, I refused to play—anyone knows what *they'll* do to your game. Of course, Stan was only kidding, but it ruined my whole day.

If you're looking for something therapeutic for your buffing problems, your next step is clear. Get in touch with American Buff Company. I'd be delighted to give you "personal" attention.

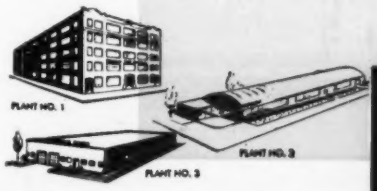
Cordially,

Sox von Liebestraum Sax

"For the Job that's TOUGH...use an AMERICAN BUFF"

World's Largest Manufacturer of Buffs and Polishing Wheels for Every Finishing Operation

Patented Centerless or Permanent Center Construction



American Buff Company

2414 S. LaSalle St., Chicago 16, Illinois • CAlumet 5-1607

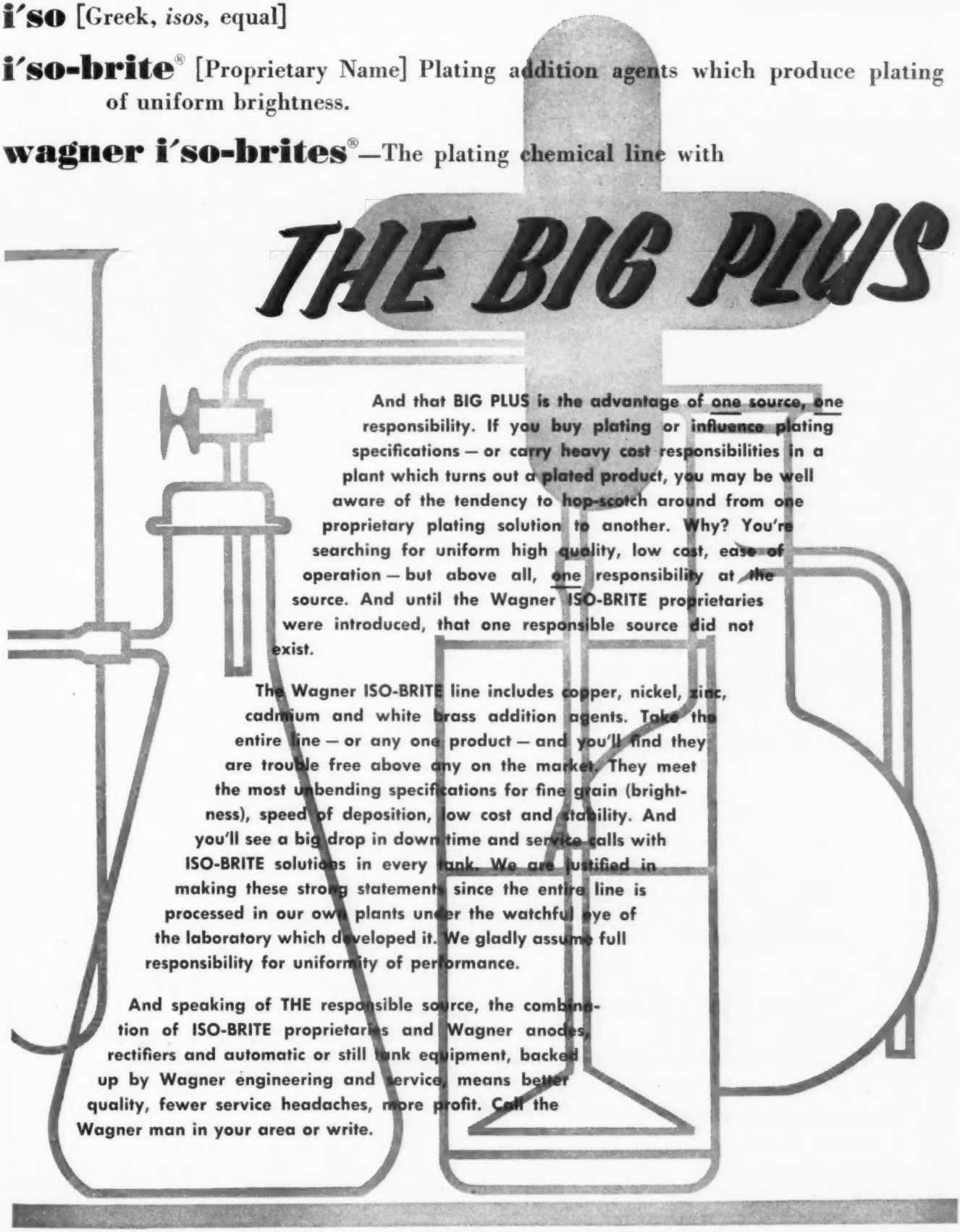
AMERICAN BUFFS ARE REGULARLY ADVERTISED IN FORTUNE MAGAZINE

i'so [Greek, *isos*, equal]

i'so-brite® [Proprietary Name] Plating addition agents which produce plating of uniform brightness.

wagner i'so-brites®—The plating chemical line with

THE BIG PLUS



And that BIG PLUS is the advantage of one source, one responsibility. If you buy plating or influence plating specifications — or carry heavy cost responsibilities in a plant which turns out a plated product, you may be well aware of the tendency to hop-scotch around from one proprietary plating solution to another. Why? You're searching for uniform high quality, low cost, ease of operation — but above all, one responsibility at the source. And until the Wagner ISO-BRITE proprietaries were introduced, that one responsible source did not exist.

The Wagner ISO-BRITE line includes copper, nickel, zinc, cadmium and white brass addition agents. Take the entire line — or any one product — and you'll find they are trouble free above any on the market. They meet the most unbending specifications for fine grain (brightness), speed of deposition, low cost and stability. And you'll see a big drop in down time and service calls with ISO-BRITE solutions in every tank. We are justified in making these strong statements since the entire line is processed in our own plants under the watchful eye of the laboratory which developed it. We gladly assume full responsibility for uniformity of performance.

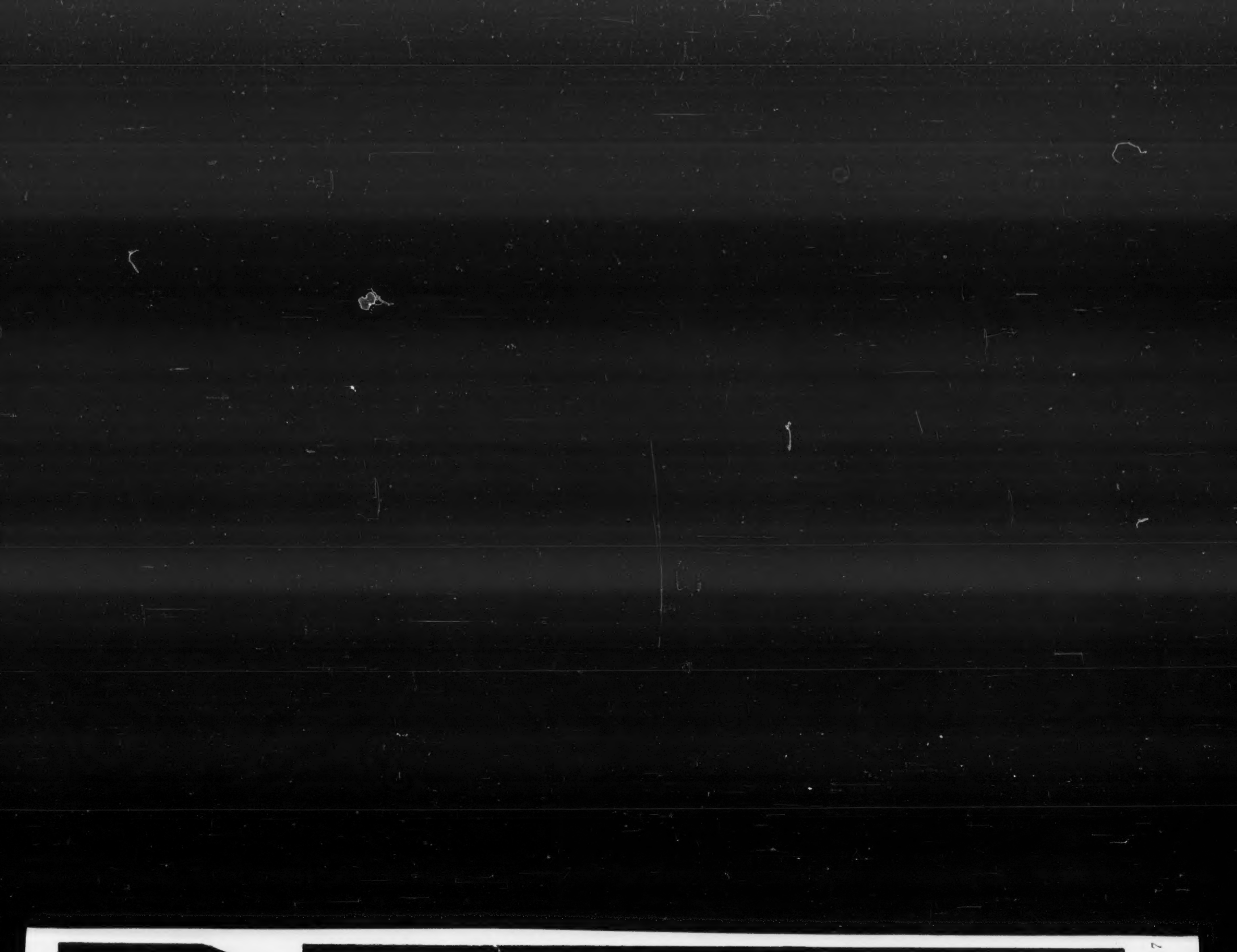
And speaking of THE responsible source, the combination of ISO-BRITE proprietaries and Wagner anodes, rectifiers and automatic or still tank equipment, backed up by Wagner engineering and service, means better quality, fewer service headaches, more profit. Call the Wagner man in your area or write.

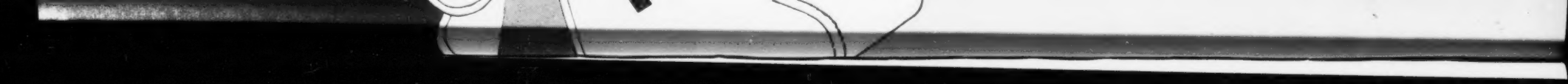
MANUFACTURERS AND PROCESSORS OF ALL METAL-FINISHING CHEMICALS, ANODES, AND EQUIPMENT

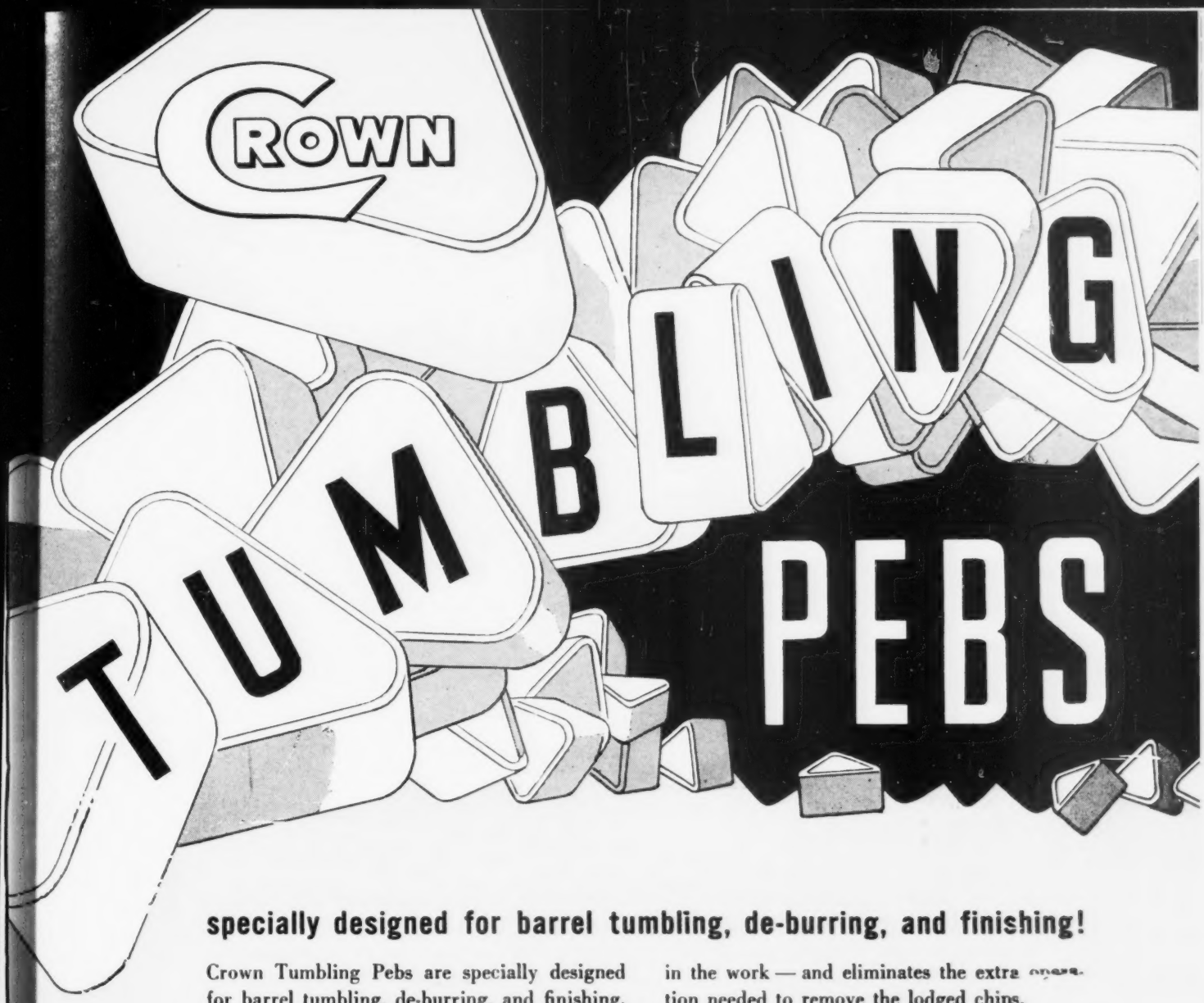
400 MIDLAND AVE., DETROIT 3, MICHIGAN

CHICAGO • CINCINNATI • CLEVELAND • INDIANAPOLIS • NEW YORK • ROCHESTER • GRAND RAPIDS

Wagner BROTHERS INC.







specially designed for barrel tumbling, de-burring, and finishing!

Crown Tumbling Pebs are specially designed for barrel tumbling, de-burring, and finishing. They are manufactured of a tough, white ceramic, uniform in size and shape, and available in a variety of sizes. Crown Pebs have many advantages in tumbling operations and are widely used for de-burring and similar tumbling processes in many types of barrel tumbling equipment.

Eliminates lodging in holes . . . Crown Pebs eliminate the "lodgement" hazard of random shaped chips. Just select the proper size, and the uniform size and shape of the Crown Pebs eliminates lodging in holes, recesses, and slots in the work — and eliminates the extra operation needed to remove the lodged chips.

Longer life . . . The tough wear resistant ceramics in Crown Pebs give a service life several times longer than either natural stones or the aluminum oxide type of tumbling chips.

Crown Tumbling Pebs do not cut as rapidly as random shaped natural stones and aluminum oxide chips, but the uniform results and their much longer life make them very valuable in many tumbling and de-burring operations.

Samples sent on request.

CROWN RHEOSTAT AND SUPPLY COMPANY

3465 N. KIMBALL AVENUE • CHICAGO 18, ILLINOIS

SIKORSKY AIRCRAFT

DIVISION OF UNITED AIRCRAFT CORPORATION

STRATFORD, CONNECTICUT

November 15, 1956

Industrial Waste Treatment Dept.
Graver Water Conditioning Co.
216 West 14th Street
New York 11, N. Y.

Gentlemen:

You will be interested in the results of a recent, nation-wide survey of State Health and Water Pollution agencies. The aim of this survey was to compose a National Honor Roll of the most prominent industrial waste treatment projects put into operation during 1955-1956.

The Sikorsky waste facilities, which include five Graver Rota-Rake Sedimentation units for the disposal of plating and other wastes, was chosen as the outstanding plant in the State of Connecticut.

Very truly yours,
SIKORSKY AIRCRAFT

Nelson H. Downs

Nelson H. Downs
Assistant to the
General Manager

NHD:ss

GRAVER®

Industrial Waste Dept. W-512
GRAVER WATER CONDITIONING CO.
Division of Graver Tank & Mfg. Co., Inc.
216 West 14th Street, New York 11, N. Y.

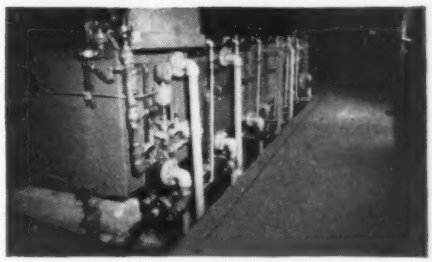
Completely automatic, unattended unloading end of the Stevens Automatic Barrel showing control panel and rectifier site located above machine.

Unistrut says— "COSTS 50% LOWER— FINISH BETTER with . . . STEVENS AUTOMATIC BARREL MACHINE"

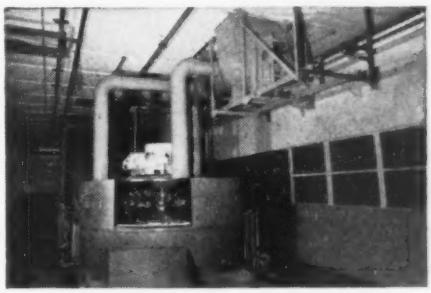
Every day in the Unistrut Corporation plant, Wayne, Michigan, thousands of small parts are zinc plated and shipped to Unistrut warehouses throughout the United States. All of these parts are zinc plated automatically by a Stevens Automatic Barrel Machine.

Unistrut high standards require a uniformity of plate on the parts used in their metal framing systems. But since installing the Stevens Automatic Barrel they have reported other advantages as well—"less handling, smaller inventories and quicker shipments." When you consider the 50% cost savings of actual plated parts too, it all adds up to a terrifically profitable investment.

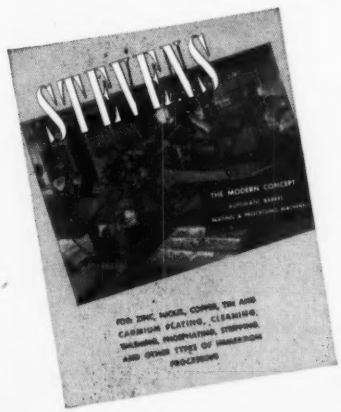
Why don't you tell us your metal finishing problems and let us make recommendations. There's no obligation.



Side view of machine showing excellent drainage system.



Plating section of machine with ventilating duct work.



Write today for your copy of the 1957 bulletin, "The Modern Concept . . . Stevens Automatic Barrel Processing and Plating Machine." Write to Frederic B. Stevens, Inc., 1800—18th Street, Detroit 16, Michigan.

STEVENS 75 YEARS OF SERVICE

FREDERIC B. STEVENS INCORPORATED

YOUR METAL FINISHING SUPERMARKET

DETROIT 16, MICHIGAN

BALANCED QUALITY*

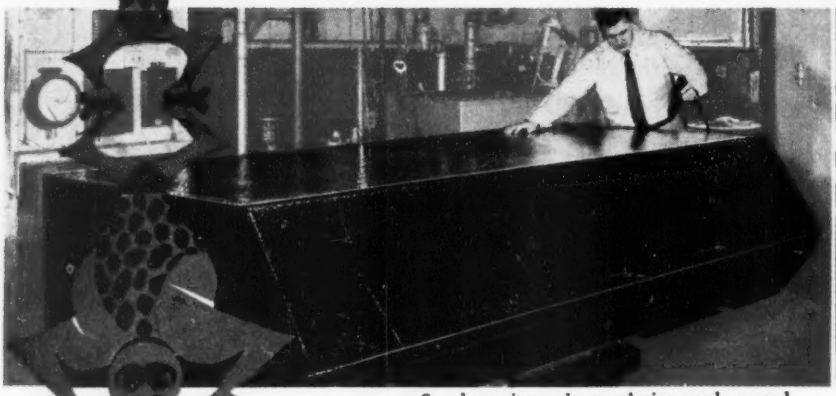
Keeps MICCROSOL on top

Developed originally as a coating for plating racks, Miccrosol E-1003 has all the desirable characteristics which make it an ideal coating for many other applications.

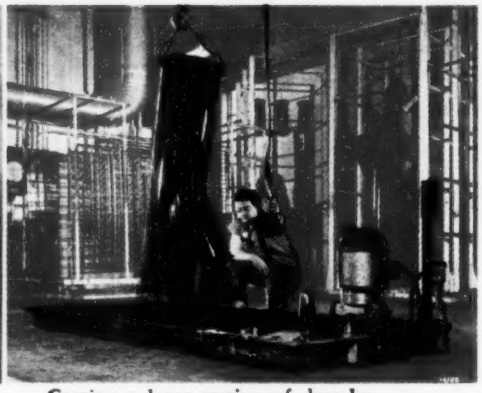
The chemical resistance of Miccrosol is unequalled in its field. Its toughness, abrasion resistance, resilience, and flexibility are unsurpassed. It's easy to apply in either a *dip* or *spray* formula. When necessary, it's easy to repair.

Year after year we build this quality into Miccrosol, improving it whenever possible and practicing every economy in its manufacture that does not compromise the excellence of the product.

This BALANCED QUALITY enables you to use Miccrosol *profitably* while assuring your customers of coating jobs that will prove superior in their performance.



Spark testing a large plating tank coated with Miccrosol Spray S-2003.



Coating a large section of duct by dipping in Miccrosol E-1003.

*Outstanding performance and value

MICHIGAN CHROME *and Chemical Company*

8615 GRINNELL AVENUE • DETROIT 13, MICHIGAN

Products

Developed and manufactured by experienced platers and coaters

FOR TANKS, DUCTS, AND OTHER EQUIPMENT

"Harry, why did the boss switch to Dow Trichloroethylene?"

"That's simple, Jess—he figures it does a better job."

"In what way?"

"High solvent power, high stability. Superior degreasing performance thoroughly removes oils, tars and resins. Special inhibitors keep it stable after repeated degreasing and distillation runs. All around high quality."

"Nothing low down about this solvent, eh, Harry?"

"On the contrary. Relatively low boiling point makes it easier to handle the work after degreasing. And the narrow boiling range indicates the purity of the solvent."

"Sounds like it will do a good job."

"That's right, Dow Trichloroethylene does a good cleaning job and is safe to handle, too. Classified as nonflammable and nonexplosive at ordinary temperatures. Doesn't produce a flash by either the closed cup or open cup test."

"Say, Harry, sounds like you're selling this stuff."

"I'm not, but Dow is."

"Who?"

"Dow. Same people who sell Dow Perchloroethylene Industrial for vapor degreasing, Dow Methylene Chloride for stripping and Chlorothene® for cold cleaning. THE DOW CHEMICAL COMPANY, Midland, Michigan."

YOU CAN DEPEND ON DOW

Special Reports On Finishing Non-Ferrous Metals

NUMBER II—Paint Base, Corrosion-Resistant Finishing with Iridite

WHAT IS IRIDITE®?

Briefly, Iridite is the tradename for a specialized line of chromate conversion finishes. They are generally applied by dip, some by brush or spray, at or near room temperature, with automatic equipment or manual finishing facilities. During application, a chemical reaction occurs that produces a thin (.00002" max.) gel-like, complex chromate film of a non-porous nature on the surface of the metal. This film is an integral part of the metal itself, thus cannot flake, chip or peel. No special equipment, exhaust systems or specially trained personnel are required.

Chromate conversion coatings are well known and accepted throughout industry as an economical means of providing corrosion protection, a good paint base and decorative finishes for non-ferrous metals. However, continued developments have been so rapid and widespread that many manufacturers may not be completely aware of the breadth of application of this type of finish. Hence, this digest of current information; to bring you up to date on the many ways in which you can obtain proper surface preparation for painting and increase product durability with a single multi-purpose chemical pretreatment. Report I on decorative, corrosion-resistant finishes and Report III on chemically polished, corrosion-resistant finishes are available on request.

First, it is an accepted fact that metal surfaces should be prepared before painting to make possible an efficient paint system. Naturally, this preparation should provide for good initial paint adhesion. Chemical treatments have proved extremely effective in this respect, particularly those of a neutral or preferably acid nature. Further, to be most efficient, chemical treatments should provide a non-porous barrier to maintain adhesion by sealing the metal from the paint and moisture. They should also provide a self-healing film which prevents lateral corrosion in the event that bare metal is exposed through scratching.

The Iridite chromate conversion coatings meet all these requirements. Iridite is a chemical conversion treatment for surface preparation. It provides initial paint bonding by molecular adhesion. It is acid in nature and produces a film that is gel-like and non-porous in structure. Thus, the Iridite film effectively seals the metal from the paint and from moisture penetration. Because the film contains certain relatively soluble constituents, it will protect areas scratched through to bare metal and prevent lateral corrosion. This is accomplished by a gradual leaching of these constituents into the damaged area.

Further, because of its gel-like, non-crystalline nature, the Iridite film will not affect the appearance or texture of the paint film, nor will it dust or powder to mar the painted surface. Because the film is non-porous, paint coverage is increased, thus substantial savings in paint costs will be realized. In addition, treated parts may be stored for long periods of time prior to painting without the risk of entrapped moisture causing blistering when painting.

Iridite chromate conversion coatings are widely used with equal ease and success under both baked and air-dried paint systems. While the actual adherence properties of the Iridite film do not increase appreciably with its thickness, corrosion protection does. The protection of the Iridite film is proportionate to its thickness and should be taken into consideration when selecting the Iridite to meet your needs. However, it is sometimes necessary to sacrifice maximum corrosion protection for appearance when a finished part is to be only partially painted. For example, it may be desirable to use a thin, clear, bright Iridite film if the unpainted areas must present a chrome-like appearance. A typical case is that of instrument housings on which the exterior is painted and the inside left unpainted.

On the other hand, if all surfaces of the product are to be painted and maximum corrosion protection is required, the heavier and most protective Iridite films should be used. For example, all surfaces of zinc die cast fruit juicers are finished with a highly protective Iridite film prior to painting to provide maximum resistance to the corrosive action of fruit juices.

Iridite finishes are now available for all commercial forms of the more commonly used non-ferrous metals, including zinc, cadmium, aluminum, magnesium, silver, copper, brass and bronze. In addition to providing an excellent base for paint, the Iridite films also have high decorative value when used as final finishes in themselves.

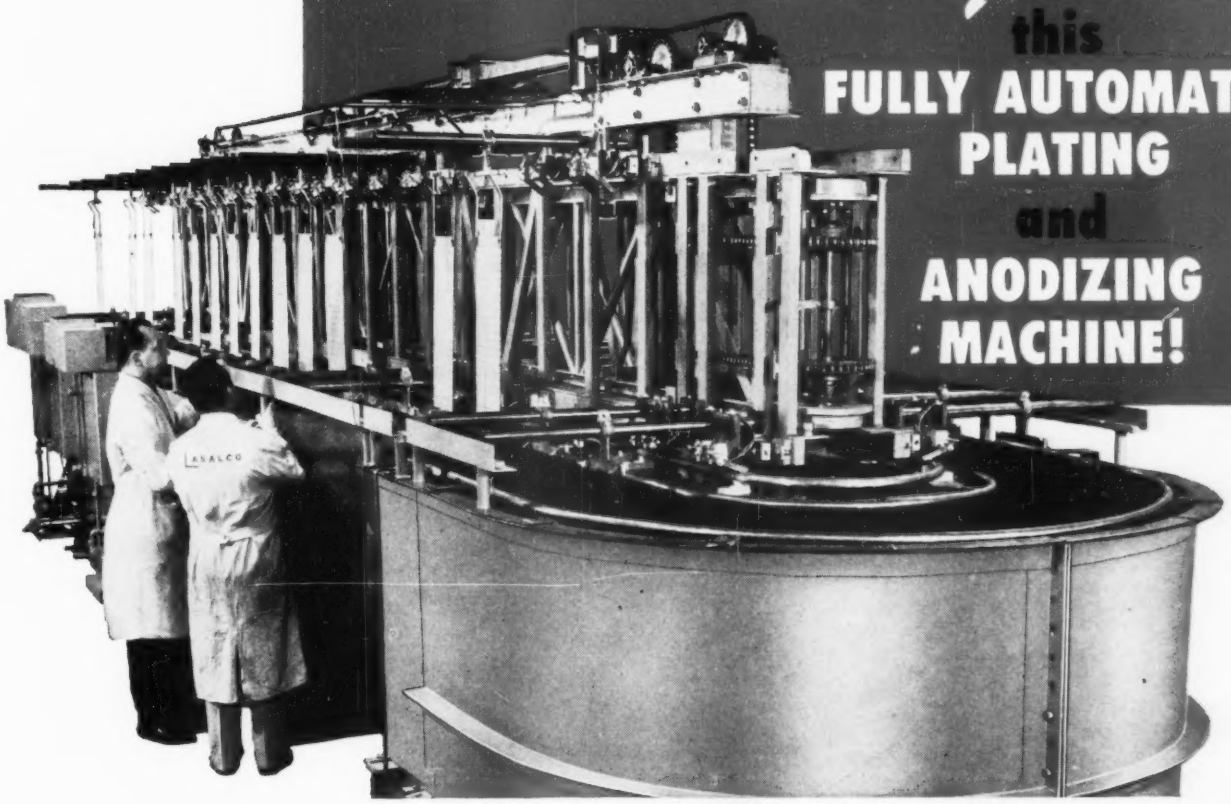
These films can produce a wide variety of pleasing appearances including clear bright, iridescent yellow, bronze, olive drab and brown. In addition, many films can be modified by bleaching or by dyeing. Among the dye colors available are various shades of red, yellow, green, blue or black.

In planning or designing, you should consider the many other characteristics of Iridite finishes which may enter into the specific problem. In addition to their functions as protective and decorative finishes, and as bases for organic finishes and bonding compounds, Iridites have low electrical resistance. Some can be soldered and welded. The film does not affect the dimensional stability of close tolerance parts.

Iridites are widely approved under both Armed Services and industrial specifications because of performance, low cost and savings of materials and equipment.

You can see then, that with the many factors to be considered, selection of the Iridite best suited to your product requires the services of a specialist. That's why Allied maintains a staff of competent Field Engineers—to help you select the Iridite to make your installation most efficient in improving the quality of your product. You'll find your Allied Field Engineer listed under "Plating Supplies" in your classified telephone book. Or, write direct and tell us your problem. Complete literature and data, as well as sample part processing, is available. Allied Research Products, Inc., 4004-06 East Monument Street, Baltimore 5, Maryland.

One Man Can Operate this FULLY AUTOMATIC PLATING and ANODIZING MACHINE!



LASALCO'S Cycleflex

- No costly overhaul or rebuilding is required for cycle changing on this *most versatile of all automatics*. Only the positions of pick-up heads need be moved, plus minor tank partition changes.
- All possibility of conveyor breakdown is eliminated with the electro-mechanical control and safety device. These make it impossible to push racks into side of tank and, in case of power failure during working transfer, prevents load from dropping.
- Because no elevating mechanism operates above rack carrier unusually low headroom is needed.
- Self-cleaning heavy duty contacts have positive 6-point connection . . . practically no attention is required.
- Tank surfaces are left clear by easily removable rack carriers . . . an advantage in servicing and in manual plating of large pieces.
- Automatic loading and unloading of parts from standard double-spine racks is available.
- Where conversion coatings and bright dips are used, a delayed set-down arrangement can be furnished to work automatically with the cycle.
- Where more than one cycle is required, machine can be made to include by-passing.

Write For Brochure

Hydraulic operation, standard; pneumatic operation, optional.

MAIL THIS TODAY!

Lasalco, Inc.
2820 LaSalle St.
St. Louis 4, Missouri
Send brochure on new fully automatic Cycleflex.

Company.....

Street Address.....

City..... Zone..... State.....

Signed.....

LASALCO, INC.

HOME OFFICE: 2820 LaSalle St. • St. Louis 4, Mo. • PRospect 1-2990
IN TEXAS: 1113 Perry Road • Irving (Dallas), Texas • BLackburn 3-4921

This is the house that BETTER CLEANERS BUILT!

Twenty-five years ago Northwest Chemical Company was founded with the express idea of supplying BETTER cleaners to the trade. Today, thanks to a steadfast adherence to the policy of top quality ingredients carefully blended with mature experience and pleasingly flavored with good service, Northwest has attained a position of respected leadership in the cleaner field.

A cleaner is only as good as the house behind it. Today's fast changing materials and methods quickly obsolete yesterday's products and create a need for completely new types of cleaners.

Northwest's continuing research program offers our customers the BEST advanced thinking, no matter what the problem. You are paying for Northwest's plus values wherever you buy. Why not avail yourself of them?

OUR 25th YEAR

Northwest products are manufactured on the west coast by—
ALERT SUPPLY COMPANY • Los Angeles

LO-HI pH

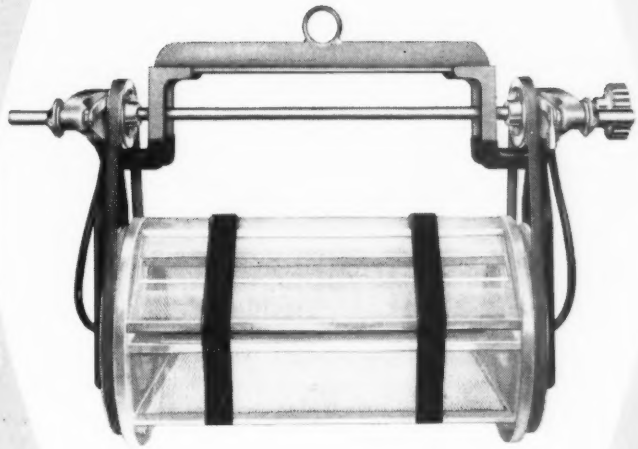
NORTHWEST CHEMICAL CO.

9310 ROSELAWN DETROIT 4, MICH.

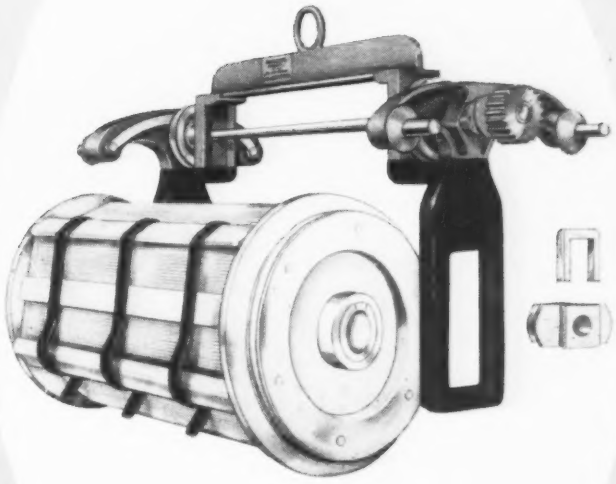
pioneers in pH cleaning control *serving you since '32*

the NEW STUTZ COMPLETE CYCLE BELT DRIVEN PLATING CYLINDER

MODEL A



This design incorporates cylinder pulleys separate and smaller from the cylinder head. The hanger arms are semi-steel castings protected with 5/16" thick special vulcanized hard rubber.



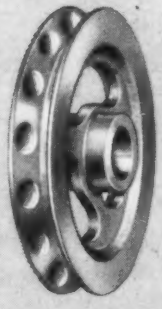
Simply lifting the top piece vertically from the dangler holder, allows the holder to be withdrawn through the hanger slot. This releases the cylinder from the hanger.

- *NO CYLINDER GEARS* • *NO CYLINDER BEARINGS*
- *LOWEST POSSIBLE MAINTENANCE* • *HIGHEST POSSIBLE CURRENT*

These units are the result of our experience with industry and service plating. The belt design has now proven superior to gear driven types, and with outboard mounted driving pulleys, belts can be changed if necessary, in seconds without tools. In addition to our own equipment these units made to fit all makes of plating tanks and furnished also with motor drives mounted directly on cylinder superstructure. Cylinder current horns are heavy copper alloy and are sized for either four or three horn saddle contact. Cathode contactors are dangler type, others available. Standard sizes 14"x30" and 14"x36" (I.D.) 12 additional sizes from 12"x24" to 18"x42" (I.D.) Standard perforations 3/32" round on 3/16" centers. Special dual openings for processing of extremely small parts available.

Write for Catalog and Prices

Pat. Pend.



Specially designed count pulleys of monel metal plexiglas with deep dimp for positive grip agair belt face.

This shows the belt expanding into the dimples of the driving pulleys. This action provides positive pull with no abrasion to the belt whatsoever.

THE STUTZ COMPANY
4430 West Carroll Ave., Chicago 24, Illinois

Complete Metal Finishing Equipment and Supplies

Coming soon... More H_2O_2 for a Growing Industry

A new Shell Chemical plant—soon to be on stream at Norco, Louisiana—will help fill the requirements of the rapidly expanding H_2O_2 market. This important new source represents a considerable increase in the national capacity, timed to coincide with expanding developments in hydrogen peroxide chemistry.

In addition to its time-honored application as a textile and pulp bleach, H_2O_2 is finding increasing uses in chemical oxidation, epoxidation and as a chemical intermediate.

To assist you in using hydrogen peroxide, Shell Chemical offers to share its technical experience. Laboratory facilities and a field staff are at your disposal. As a major consumer of hydrogen peroxide, Shell Chemical also can assist you with storage and handling problems.

Your Shell Chemical representative will be glad to consult with you on your H_2O_2 problems. Write to:

SHELL CHEMICAL CORPORATION

CHEMICAL SALES DIVISION, 380 Madison Avenue, New York 17, New York

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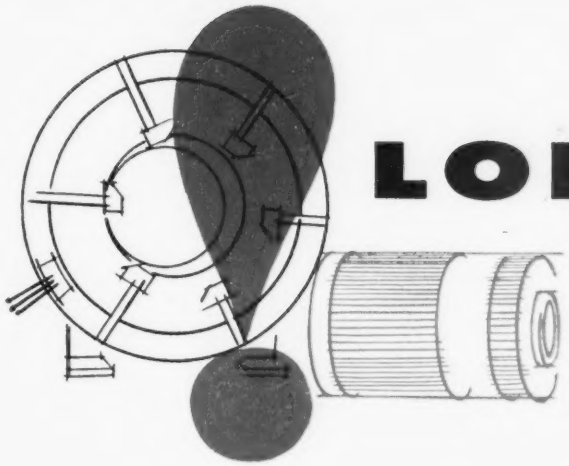
IN CANADA: Chemical Division, Shell Oil Company of Canada, Limited • Montreal • Toronto • Vancouver

SHELL



LONGER LIFE

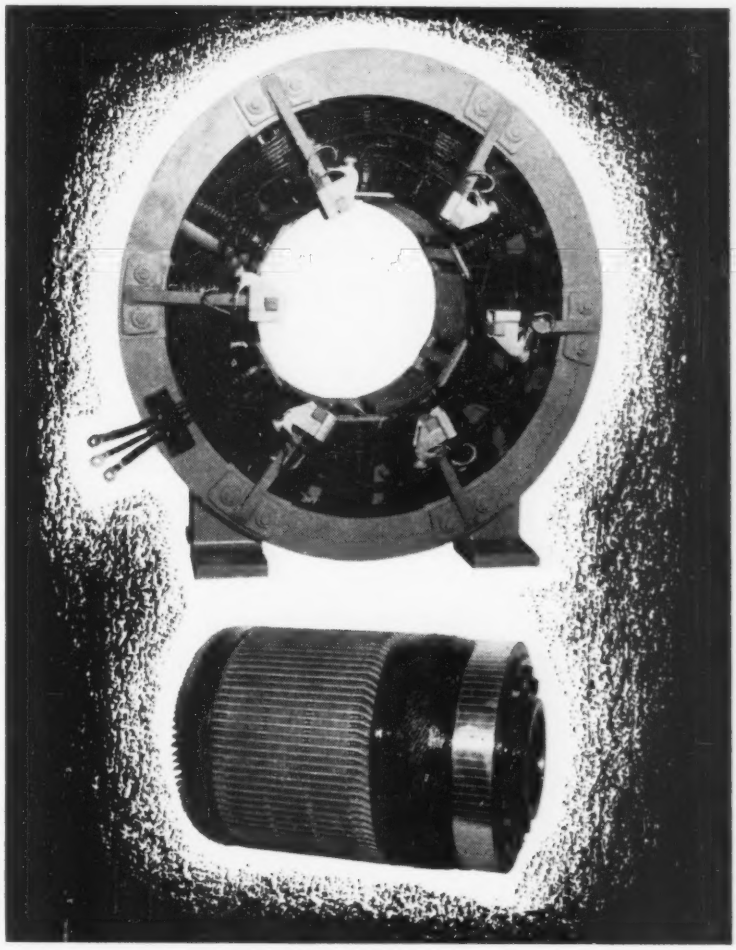
proves motor generators are your best investment in power conversion equipment

Chandeysson GENERATORS

outlive by 4 to 1, provide ample overload capacity plus versatility

Chandeysson Motor Generators are built to last and last. In fact, the life of an M. G. set is more than 40 years, while that of other forms of power conversion equipment is often only 10 years. Note the large over-sized exciter commutator and open construction. Just one more reason why Chandeysson sets are capable of carrying up to 150% load for short times without damage.

These are just a few examples of Chandeysson *performance* engineering. Behind every generator are decades of engineering and manufacturing know-how . . . consistent employment of only the finest, most durable materials . . . and user testimony to highest standards of performance and life-long service. For extra capacity to meet emergencies at the lowest possible cost . . . whatever your needs are in power conversion equipment . . . insist on Chandeysson low-voltage generators.



GET ALL THE FACTS on how you can gain lifetime power dividends with a Chandeysson Motor Generator set. Mail this coupon . . . Now!

CHANDEYSSON ELECTRIC COMPANY CHA-92
4074 Bingham Avenue, St. Louis 16, Mo.

Please send new booklet D-103

Name..... Title.....

Company.....

Address.....

City..... Zone..... State.....

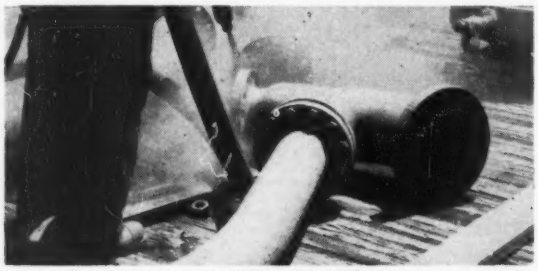
CHANDEYSSON ELECTRIC COMPANY • **4074 Bingham Avenue, St. Louis 16, Missouri**

Four Different TUMBLEX* Abrasives assure best possible results in barrel finishing. TUMBLEX "A", most popular for general needs, removes flash, scale, burrs and tool marks, while forming radii and finishes to required microinches. TUMBLEX "T" is bonded, triangular and fast-cutting for special intricate parts, and won't wedge in work slots or holes. TUMBLEX "S", exceptionally dense and long lasting, is bonded spheres that get into areas where other shapes won't reach. "A", "T" and "S" are all made of famous ALUNDUM* (aluminum oxide) abrasive. TUMBLEX "N" is natural stones, exclusively Norton, of rounded shapes that bring up high lustre, especially on die castings and soft metals.

HERE'S HOW TO

Choose the best abrasive for any metal finishing job

Better Polishing With Every Set-Up — wheels or belts — is easy when you standardize on Norton ALUNDUM abrasive grain. All types are extremely hard and tough, uniform in size, structure and chemical composition and have high capillarity for easy wetting. Type "S", sizes 14 to 90 grit and Type "R", sizes 100 to 240 grit, are noted for fast cutting and the satin finish which they produce. Type "B", sizes 20 to 600 grit, is an all-purpose, blocky, durable grain capable of producing fine finishes.



Fast Cut. Norton ARROW-BLAST* aluminum oxide grain cuts faster than natural abrasives and reduces dust on pressure blasting jobs to minimum. And remember, the less dust in any environment, the longer your operators can work, and the more they'll finish — at lower cost.

Norton tumbling, polishing and blasting materials add "Touch of Gold" advantages to countless applications

Your metal parts can range from tiny needles to hefty forgings. They may be simple or complicated, hard or soft. Whatever they require in polishing or finishing, you can get plenty of "Touch of Gold" benefits from the wide range of Norton abrasives. Find out how. Ask your Norton Distributor for the illustrative, instructive booklets on barrel-finishing, metal polishing, or both. Or write to NORTON COMPANY, General Offices, Worcester 6, Mass. Plants and distributors around the world.

*Trade-Marks Reg. U. S. Pat. Off. and Foreign Countries G336

NORTON
ABRASIVES
Making better products . . . to make your products better

NORTON PRODUCTS
Abrasives • Grinding Wheels • Grinding Machines • Refractories
BEHR-MANNING DIVISION
Coated Abrasives • Sharpening Stones • Pressure-Sensitive Tapes

Udylite Machine and Process combine to set new Scripto standards

The Udylite Cyclemaster provides the accuracy and steady flow of production. Udylite Bright Nickel furnishes the sparkling finish. Together they solve for Scripto, of Atlanta, Georgia, the knotty problem of better finish of the Scripto pens, pencils and cigarette lighters.

Scripto's first bright nickel was the Udylite #31 process. It was superseded by the Udylite #514 process to gain the faster brightening which is so important in nickel plating to a high luster with a thin coat.

The adoption of Udylite Bright Nickel Process #724 was the next step as it offered still faster brightening and even more important all the time saving advantages of all liquid brighteners.

Step by step Scripto has lowered costs and improved quality with Udylite Processes and Precision Automatic Plating. Here is just one of many examples of the right application of process and equipment. Out of the line of Udylite products can come the answer to your problem as well.

Contact your local Udylite Sales Representative . . . let him show you how the *right* combination of Udylite processes and machines can improve your quality and production.

THE Udylite CORPORATION
DETROIT 11, MICHIGAN

WORLD'S LARGEST
PLATING SUPPLIER

PLATING PROBLEMS
IN INDUSTRY – NO. 3

REDUCING ANODE CONSUMPTION

HUBLEY USES OFHC® ANODES TO GET MORE PLATING COPPER PER POUND OF ANODE

At Hubley, one of Santa's largest workshops, hundreds of toy guns are plated every hour with high-purity OFHC Brand Copper Anodes. 32-inch lengths of 2- x 3-inch OFHC ovals are used as well as 3-inch lengths of 2-inch OFHC rounds for barrel-plating.

Producing quality toys with eye-appeal to sell at competitive prices demands the best finishes possible at the most economical cost. That's why Hubley—one of the world's foremost toy manufacturers—plates with OFHC Brand Copper Anodes.

Hubley plating men attest that anode consumption for a specified coverage and thickness of plate has been reduced appreciably since they changed to OFHC Anodes.

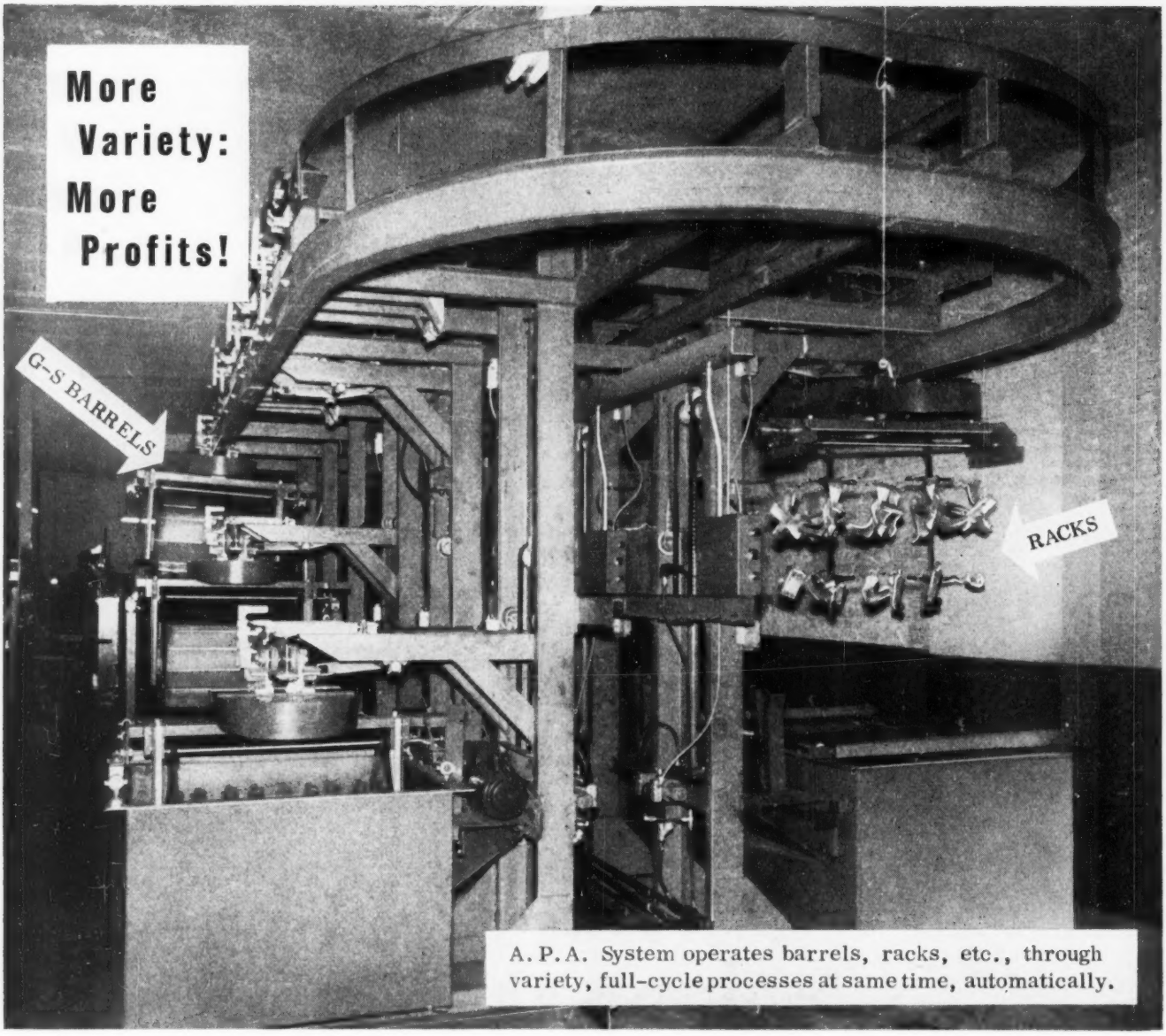
OFHC Anodes yield these results because OFHC means *more plating per pound of copper*. OFHC is completely free of porosity—equal in density to forged copper, is 99.99+% pure, contains no oxides, no deoxidants. And OFHC Anodes' characteristically long-grained crystal structure and high purity combine to resist undercutting of small grains. This fact both minimizes the amount of copper wasted through the loss of small grains and eliminates the roughness caused by small particles free in solution.

To find out how the extreme purity of OFHC Copper Anodes can benefit your own electroplating operation, contact your distributor or our nearest office directly.

THE AMERICAN METAL CO., LTD.

61 Broadway, New York 6, N. Y.

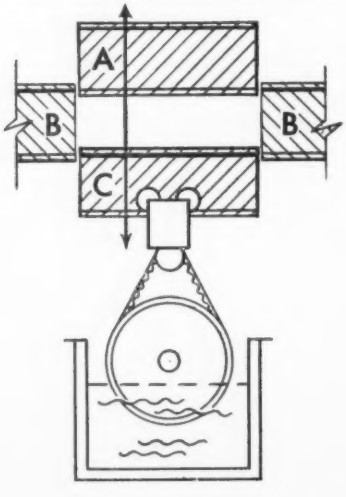
BOSTON — CHICAGO — DETROIT — LOS ANGELES



A. P. A. System operates barrels, racks, etc., through variety, full-cycle processes at same time, automatically.

NOW . . . *Your Multi-Processing Goes* ***Automatic***

As bottom track-segment "C" lowers carrier to tank, "missing link" track-segment "A" drops into place, closing gap in track "B". Other carriers travel over units in process, all-automatic.



World's First and Only Fully Flexible Automation System for Your Variety Job Plating, Tank Line Operations.

Abbey Process Automation System: (Patent-protected) New, better way of life for job platers. Solves old problem of "flexibility" in automation for average job-type operations. First to put multiple processing on a fully automatic basis. Operates your present tank lines through all your variety processing, station-by-station, simultaneously, without manpower, without chain hoists. ***One control center;*** set it and forget it. Perfect timing — all cycles — all processes. Vary at will — any carrier, any cycle. Electro-mechanical safety devices and signal system make it fail-proof. No manual operations between loading and unloading. ***Eliminates human element.*** Eliminates hoists and their maintenance. Adapts to any floor — any size, shape of space — straight or curved, etc. Installs in sections, by station — any number desired. ***Change at will.*** No anchoring to floor. Ties-in to standard overhead conveyors. Carrier elevator at each station individually powered and controlled. Barrels, racks, etc., function independently — can't interfere with each other. Original equipment: G. S. Full-Cycle "Cogged-V-Belt" Drive Barrels, or adapt to your own barrels. Carriers in transit "leap-frog" those in process automatically. (See "missing link" diag. at left.) Learn how *you* can go automatic for *less* with A.P.A. System. Get all the facts now!

The G. S. Equipment Co.

15585 Brookpark Rd., Cleveland 11, O., CLearwater 2-4774

Spread Eagle Bookends

by *Virginia Metalcrafters*

VIRGINIA METALCRAFTERS
VM
REG. U.S. PAT. OFF.

finished with **Lea compound**

These heirloom gifts are hand cast in solid brass and hand finished using Lea Compound. Virginia Metalcrafters of Waynesboro are famous for their colonial reproductions in Brass, Iron, Pewter and Tin. For the high grade finish such reproductions demand, they come to Lea of Waterbury.

For hand finishing or automatic finishing; for colonial or modern designs, for brass, aluminum, steel, bronze, silver or plated parts, there is a Lea Compound and a Lea Method which will give you real production economy. Write or telephone us today about your finishing requirements.

The Hallmark of Quality Products

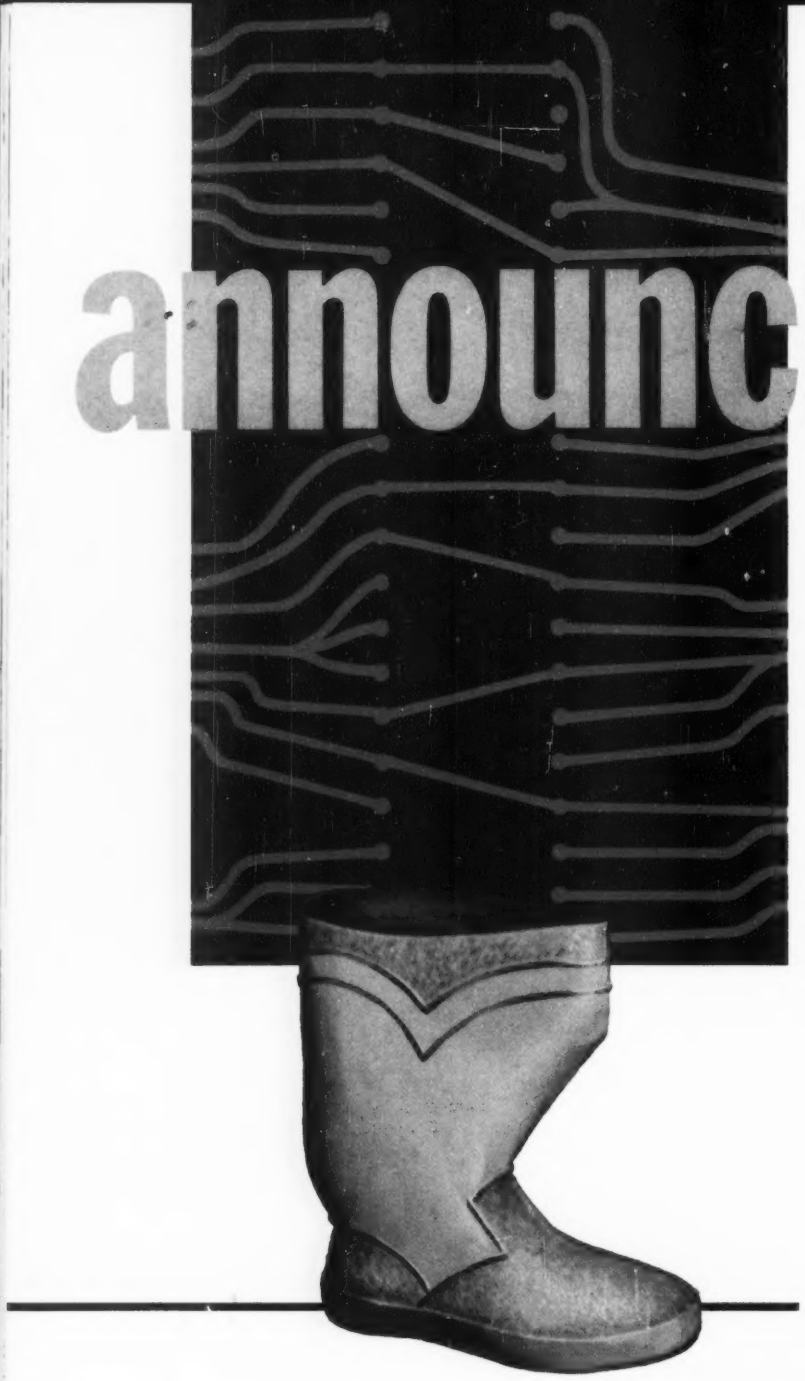
THE LEA MANUFACTURING CO.
16 CHERRY AVE., WATERBURY 20, CONN.

Lea-Michigan, Inc., 14066 Stansbury Ave., Detroit 27, Mich.
Lea Mfg. Company of Canada, Ltd., 1236 Birchmount Road Scarborough, Ontario, Canada
Lea Mfg. Company of England, Ltd., Buxton, England
Lea-Renal, Inc., Main Office and Laboratory: 139-20 109th Ave., Jamaica 35, N. Y.
Manufacturing Plant: 237 East Aurora St., Waterbury 20, Conn.

Burring, Buffing, Polishing, Lapping, Plating and Spray Finishing . . . Manufacturers and Specialists in the Development of Production Methods, Equipment and Compositions. Manufacturers of Lea Compound and Learok . . . Industry's quality buffing and polishing compounds for over 30 years.

Are you interested in Plating Specialties? **SEE THE OTHER SIDE OF THIS INSERT.** ▶

announcing...



the Cuprotype Process*

an acid-copper process for producing smooth, ductile, tree-free, heavy deposits at high speed

CUPROTYPE is a new production-tested acid copper process that provides a valuable asset to platers requiring heavy copper deposits that are smooth, ductile and tree-free, even when deposited at high current densities. CUPROTYPE is being used in electro-forming of molds, in plating of non-conductors such as printed circuits, and in electrotyping.

Plating speeds with CUPROTYPE range from 50% to 100% higher than for other acid copper processes now in commercial use. For example, one manufacturer plating molds was able to increase his rate of deposition 100% and still get smooth, ductile, tree-free deposits.

Plating thickness can be markedly increased without increasing tank capacities or plating time. Addition agents are completely stable. There is no breakdown or deterioration of solution.

If you are now or expect to be working with products requiring exceptionally heavy copper deposits, you should investigate CUPROTYPE. A letter or call to our sales offices will bring full details. Our laboratory, as always, is available for any technical help.

CUPROTYPE is one of the newer developments in a line of superior plating processes developed in the Lea-Ronal Laboratory, one of the foremost in the country in the field of specialized plating processes. CUPROTYPE has been production tested on a variety of products, each coming up with the same report: superior deposits in faster time.

The LEA GROUP
serving the Finishing Field
Lea-Ronal, Inc., Jamaica, N. Y.
Lea-Michigan, Inc., Detroit
The Lea Mfg. Co., Waterbury, Conn.
Lea Mfg. Co., of Canada, Ltd.
Lea Mfg. Co., of England, Ltd.
Plating Polishing Buffing Burring

Chemistry
L·R
Metallurgy Electroplating

*A patented process

Lea-Ronal Inc.

Sales and Manufacturing Plant:
237 East Aurora Street, Waterbury 20, Conn.

Main office and Laboratory:
139-20 109th Avenue, Jamaica 35, N. Y.

Are you interested in plating specialties? ***SEE THE OTHER SIDE OF THIS INSERT***

plating rejects ...with WYANDOTTE B. N.!

A message especially for Job Shop Operators:

HERE'S a cleaner that does *all* your job-shop cleaning – on steel, copper, brass, bronze, zinc-base die castings – gives you an efficient, round-the-clock job; cuts rejects, too!

The product? Wyandotte B. N. – a soak cleaner and versatile electrocleaner for direct and reverse cleaning.

Think of it! You need only one cleaner to take care of all job-shop needs!

B. N. gets metal so clean all over that bright plating really sparkles! It also cleans and activates nickel before chrome.

Wyandotte B. N. offers long life and maximum detergency. It is free rinsing; has high soil tolerance and concentrated alkalinity.

Switch to Wyandotte B. N. for *your* job-shop cleaning. Contact your nearest Wyandotte representative, or mail coupon, today! *Wyandotte Chemicals Corporation, Wyandotte, Mich. Also Los Nietos, Calif. Offices in principal cities.*

Wyandotte CHEMICALS

J. B. FORD DIVISION

The Best in Chemical Products for Metal Finishing

Wyandotte Chemicals Corporation
Dept. 3045 • Wyandotte, Michigan

Yes! I would like to know more about Wyandotte B. N. for use in metal-cleaning operations.

☐ **Have representative call** ☐ **Send more complete information**

Name_____ Title_____

Firm_____

Address_____

City_____ Zone_____ State_____

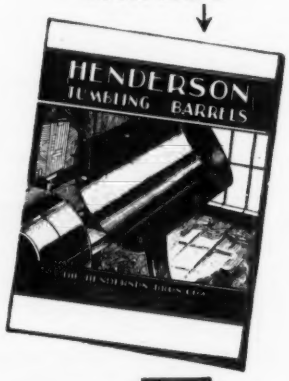
HENDERSON OFFERS THIS 3-PIECE CONSTRUCTION

Save as much as 40%

In all Henderson Horizontal Cast Tumbling Barrels, one of which is shown above, the ends are separate from the body. As the body carries the load, it wears out long before the ends do. For a long time, therefore, with Henderson barrels, you will need to replace only the bodies, merely bolting on the original ends. Compared with the cost of complete new barrels, you can thus save as much as 40%!

After long experience in the finishing field, we like to recommend cast-iron barrels for most deburring and grinding jobs, but we make rubber, Neoprene, and wood-lined barrels — over 25 types, a barrel for every conceivable finish. Besides the highest quality of material and workmanship, when you buy a Henderson, you get a lot of "know how"!

***If You're A "Tumbler" Send for This* NEW CATALOG**

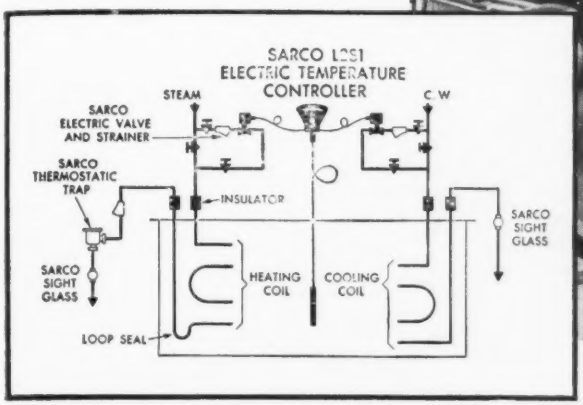


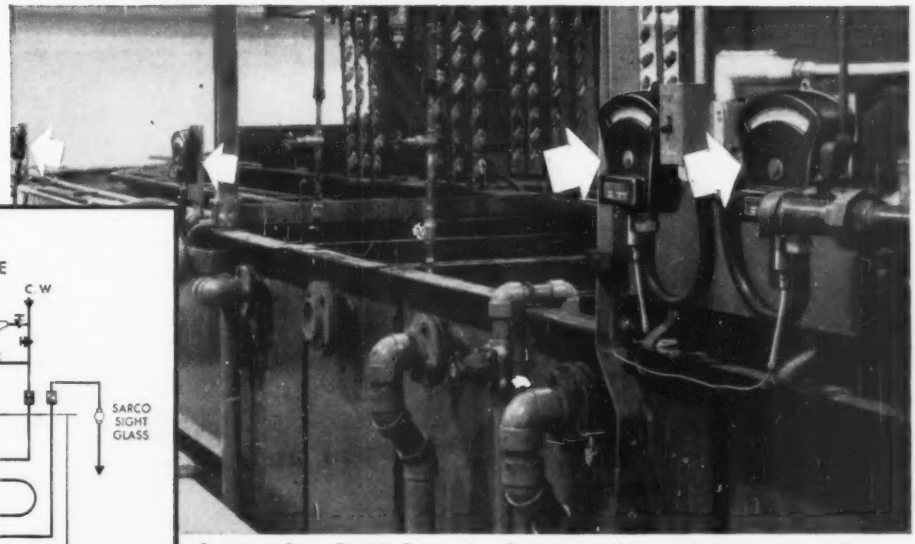
THE HENDERSON BROS. COMPANY

"The Tumbling Barrel People"

136 SOUTH LEONARD ST., WATERBURY, CONN.

SINCE 1880 . . DESIGNERS AND BUILDERS OF TUMBLING BARREL EQUIPMENT





Seventeen Sarco Electric Temperature Controllers help maintain high quality plating—cut costs—at Ronson Corporation, Delaware Water Gap, Pa. Controllers are used on chrome, nickel, copper, silver, and gold plating tanks. This is a repeat installation.

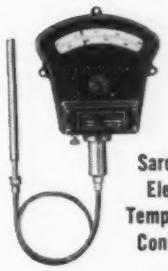
Improve plating quality—cut your costs with low-cost temperature control

Unstable bath temperatures . . . the result of erratic manual temperature control . . . are sure to lead to costly rejects, wasted man-hours and breakdown of plating solutions.

You can solve these problems at *low cost* . . . by installing always-reliable Sarco Automatic Temperature Control. Just think . . . a complete Sarco System is yours for as little as $130 a tank!

1. **You improve plating quality** because creeping temperatures are a thing of the past.
2. **You lower rejects** because solutions are held automatically to pre-set temperatures. No chance for human error to mess up a tankload . . . and cut into profits.
3. **You get better utilization of time** —platers are able to concentrate on their plating work. No worrying about bath temperatures. No turning on and off of valves.
4. **You save plating solutions** — because automatic control prevents boil-off caused by overshooting temperature.

Write for Bulletin 1025-B or consult your plating supplies jobber. Sarco Company, Inc., 635 Madison Ave., New York 22, N. Y.



Sarco LSI Electric Temperature Controller

A COMPLETE SYSTEM FOR AS LITTLE AS $130 A TANK!

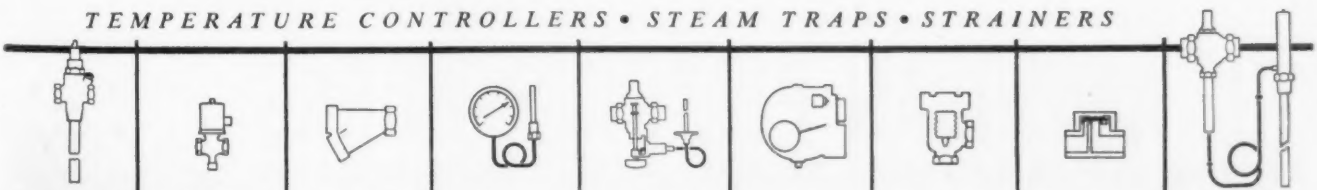
Think of it . . . automatic temperature control that often pays for itself in weeks!

Easy-to-read controller dial clearly indicates temperature being maintained. Temperature setting quickly changed by turning one knob.

2224-B

SARCO *improves product quality and output*

TEMPERATURE CONTROLLERS • STEAM TRAPS • STRAINERS



Self-operated Cooling Controls | Electric Valves (solenoid) | Strainers | Dial Thermometers | Degreaser Vapor Line & Safety Controls | Float-Thermostatic Steam Traps | Thermostatic Steam Traps | Thermodynamic Steam Traps | Self-Operated Temp. Reg.

NEW SHAPED, EXTRUDED APW SILVER ANODES

STANDARD SHAPES

CONTROLLED GRAIN SIZE: APW EXTRUSION PROCESS* controls grain size within definite limits — minimizes sheddings

These scientifically shaped anodes retain 80% of original active surface area after 85% by weight has been plated off!

Costs are lowered by prolonged anode life, minimized polarization and less silver scrap to be refined.

In addition, the APW Extrusion Process controls grain size within definite ideal limits so that corrosion is smooth and uniform. Electrodeposits are *consistently* smooth. Shedding is virtually eliminated. Rejects are a comparative rarity!

We are anxious that the silver you buy in anodes is used most efficiently and economically. Special anode shapes will be engineered to meet your particular plating bath conditions. Call or write for a representative. We'll be glad to assist with your plating problems.

*Pat. Pending

ROLLED FLAT PLATE ANODE SECTION:
This Photomicrograph shows highly irregular, uncontrolled grain size—a major cause of shedding and resultant rough electrodeposits.

APW EXTRUDED ANODE SECTION:
Small, fully controlled regularity of grain size promotes uniform corrosion, smoothest electrodeposits, less rejects.

THE AMERICAN PLATINUM WORKS

231 NEW JERSEY RAILROAD AVENUE • NEWARK 5, NEW JERSEY

APW

ENGELHARD INDUSTRIES

Sanding time cut 38% with LOWE VINOC

Another example of the kind of cost-saving ideas you can get from an experienced Lowe Brothers finishing engineer. Here's the story:

"I suggested Lowe Vinoc when the plant superintendent complained about the sanding time required with another product. Now they save 38% in sanding man-hours by spray finishing with Vinoc, and they're well pleased with its appearance. The 38% is their figure."

Let a Lowe Brothers finishing engineer help *you* find ways to reduce costs. He knows finishes *and* methods — and he'll gladly make a "flow-chart" analysis of your finishing system if you'll send the coupon. No obligation, of course.

LOWE BROTHERS
INDUSTRIAL FINISHES

QUALITY UNSURPASSED SINCE 1870

Style-tested paints for Home and Industry

REPRESENTATIVES IN: Chicago, Ill. Boston, Mass. • Jersey City, N. J. Cleveland, Ohio • Pittsburgh, Pa. Rochester, N. Y. • Dayton, Ohio Columbus, Ohio • Milwaukee, Wis. Indianapolis, Ind. • Cincinnati, Ohio Detroit, Mich. • Springfield, Mass. Philadelphia, Pa.

The Lowe Brothers Company MF-12
Dayton 2, Ohio

☐ Please have my nearest Lowe Brothers Finishing Engineer call on me as soon as possible.

NAME_____

TITLE_____

FIRM NAME_____

ADDRESS_____

CITY_____ ZONE____ STATE_____

1. UNTREATED RUSTY BOLTS

2. BOLTS DERUSTED WITH HYDROCHLORIC ACID SOLUTION AND LEFT STANDING OVERNIGHT

3. BOLTS DERUSTED WITH HOT CAUSTIC SODA SOLUTION AND LEFT STANDING OVERNIGHT

4. BOLTS DERUSTED WITH HOT CAUSTIC SODA-GLUCONATE SOLUTION AND LEFT STANDING OVERNIGHT

the case for

alkaline rust removal

when caustic solution efficiency is increased with Pfizer Gluconic Acid or Sodium Gluconate

● If you now remove rust from metal with an acid bath, you are well aware of the major disadvantages involved—hydrogen embrittlement and metal loss caused by corrosive action of the acid.

While alkaline rust removal helps solve these problems, it has, in the past, seldom been considered a practical or efficient method for production line metal finishing.

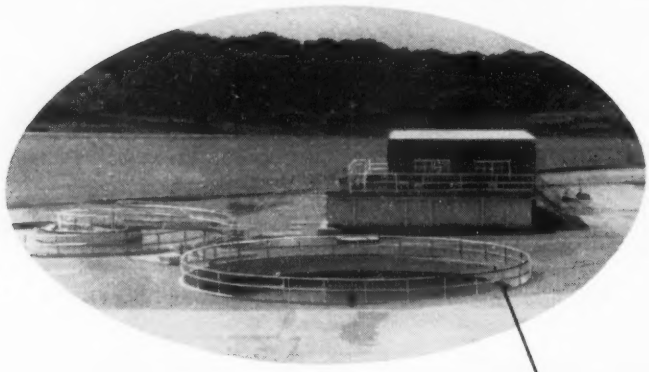
Now, however, fast alkaline rust removal and paint stripping are possible by the addition of Pfizer Gluconic Acid or Sodium Gluconate to caustic solutions. In a caustic solution, gluconic acid or sodium gluconate prevents insoluble metals from precipitating, increases efficiency of the rust removal or paint stripping, and prolongs the life of the bath.

Why not test the effectiveness of a caustic-gluconate bath in your metal finishing? See for yourself how fast action and low corrosion rates can be combined through the use of Pfizer Gluconic Acid or Sodium Gluconate in caustic baths. If you would like further technical data on this subject, write to Pfizer today.

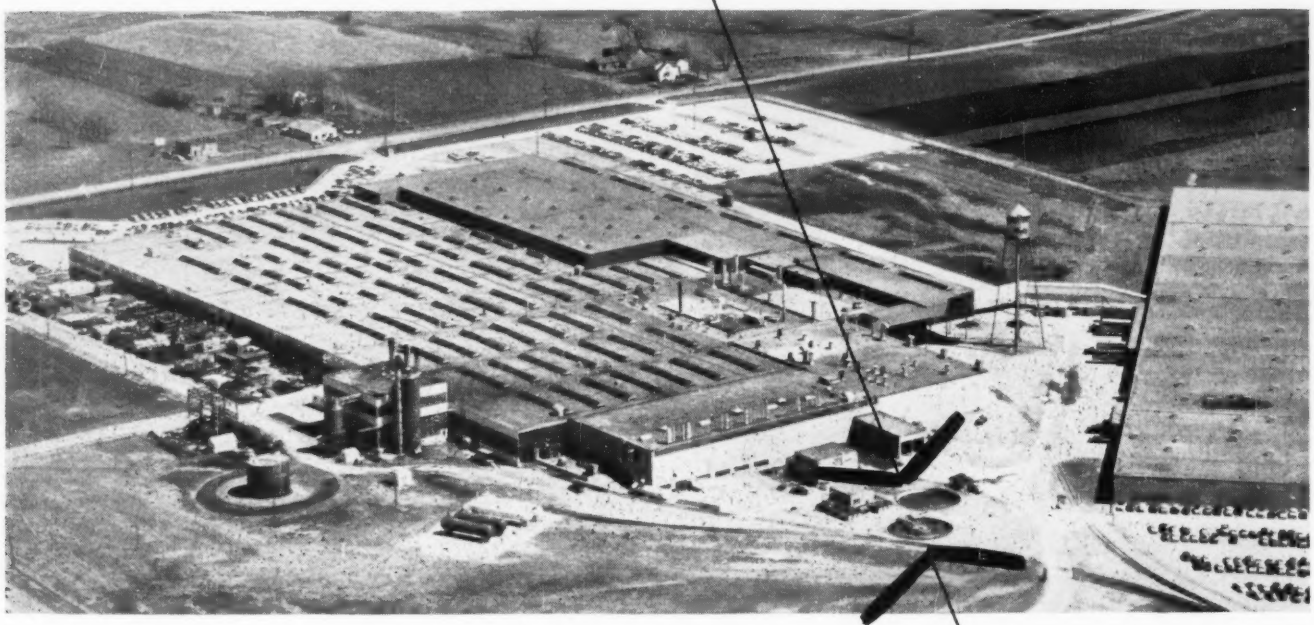
Manufacturing Chemists for Over 100 Years

Pfizer

CHAS. PFIZER & CO., INC.
Chemical Sales Division
630 Flushing Ave., Brooklyn 6, N.Y.
Branch Offices:
Chicago, Ill.; San Francisco, Calif.; Vernon, Calif.; Atlanta, Ga.; Dallas, Texas



MAYTAG TREATS ITS WASTE AND CUTS ITS WATER BILL!



Black & Veatch, Consulting Engineers
Kansas City, Missouri

At its home office and factories at Newton, Iowa, The Maytag Company recovers approximately 70% of its metal finishing waste waters for re-use in plating and other plant operations.

1 MGD of segregated wastes from pickling, phosphating, porcelain enameling, electroplating, etc., are treated in VORTI® mixer basins and a CYCLATOR® clarifier to produce an effluent suitable for disposal or water reclamation.

Let your INFILCO representative discuss your specific waste treatment problems with your engineers. Send today for the following bulletins: 850 ("CYCLATOR" clarifiers); 700 (VORTI® mixers); 1960 (CATEXER® ANNEXER® ion exchangers).

State your chemical feeder needs. Or write for Bulletin 80 for the complete line of INFILCO equipment for every type of water and waste treatment problem.

INFILCO invites inquiries on all industrial water supply and waste-water treatment problems.

INFILCO

INFILCO
INCORPORATED
General Offices • Tucson, Arizona • P.O. Box 5033
Field offices throughout the United States
and in foreign countries

57444

THE ONLY COMPANY impartially offering equipment for ALL types of water and waste processing—coagulation, precipitation, sedimentation, flotation, filtration, ion exchange and biological treatment.

(Photo courtesy of Chromium Corporation of America)

Reduce rejects—plate with Mutual low-sulfate chromic acid

When you chromium plate components like these cylinder liners for big diesels you can't risk a reject tag because the job didn't meet specifications.

One form of insurance against plating difficulties is MUTUAL Chromic Acid. Every drum is sampled and analyzed before shipment to make sure that it has a minimum assay of 99.75 per cent CrO_3, and that its sulfate content never exceeds 0.1 per cent.

Rigid quality control in the manufacture of MUTUAL Chromic Acid guarantees the uniformity of the product, making it easier for the plater to accurately control the chromic acid-sulfate ratio of his plating bath.

Mutual Chromium Chemicals

MUTUAL

Sodium Bichromate
Sodium Chromate
Chromic Acid

Potassium Bichromate
Potassium Chromate
Ammonium Bichromate

MUTUAL CHROMIUM CHEMICALS
SOLVAY PROCESS DIVISION
Allied Chemical & Dye Corporation
61 Broadway, New York 6, N. Y.

Allied Chemical

Please send:

☐ Bulletin 52 – Chromium Chemicals – Their History, Properties and Uses.

☐ Bulletin 13 – Anodizing Aluminum by The Chromic Acid Process.

NAME_____ POSITION_____

COMPANY_____

STREET_____

CITY_____ ZONE____ STATE_____

P2-9-3

THANKS . . .

. . . for telling me about the amazing new and different

HI-SOL*
ENAMEL REDUCER

Sounded too good to be true,
But it really is—
Didn't believe, when you told me,
That HI-SOL Reducer gives:

- **Less "Orange Peel"**
- **Higher Gloss**
- **Better Hiding**
- **More Body**
- **Quick Initial Set**
- **Resistance to Sagging**
- **Superior Flow**
- **Smoother Finish**

and

- **Lower Cost "at-the-Gun"**

Saves spray labor through easier application and reduces rejects due to sags and runs.
Costs less per job
Costs less per gallon sprayed.

Mail coupon below for FREE SAMPLE

☐ Yes, send me a FREE SAMPLE of HI-SOL REDUCER for Synthetic Enamels . . . at NO OBLIGATION.
The Product we make is_____
Gallons used per month_____
We want it for: ☐ Air Dry ☐ Bake
Our enamel is:
☐ High gloss ☐ Med. gloss ☐ Low gloss
Name_____
Address_____
City_____ Zone___ State_____

POTTER Paint Co.
or **Cortland 3, New York**
Cambridge City 3, Indiana
Write to your nearest location

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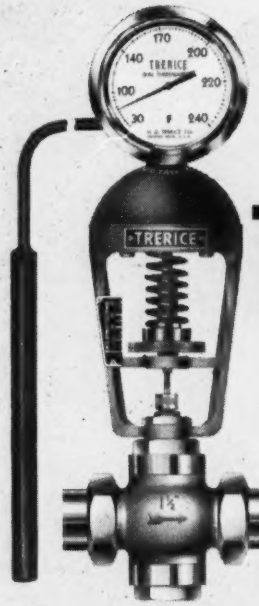

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WHY temperature control? First of all, to assure uniform quality; second, to reduce processing costs.

Maintaining bath temperatures at the *one best level* used to be a serious problem. But not anymore. Today, TRERICE controls are automating plating processes throughout the metal finishing industry . . . maintaining precise temperatures *automatically*—TRERICE regulators prevent evaporation losses, cut down on rejects, insure uniform product quality! You save time, labor and fuel costs. Not surprising, then, that TRERICE controls are standard with leading original equipment manufacturers. Behind this wide acceptance is the TRERICE reputation for quality, and a nationwide sales and service organization.

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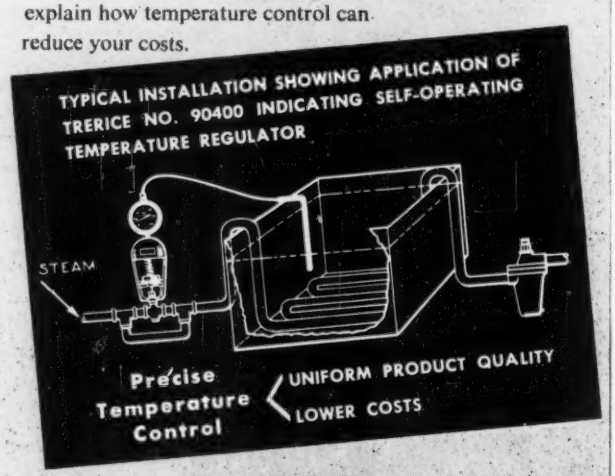

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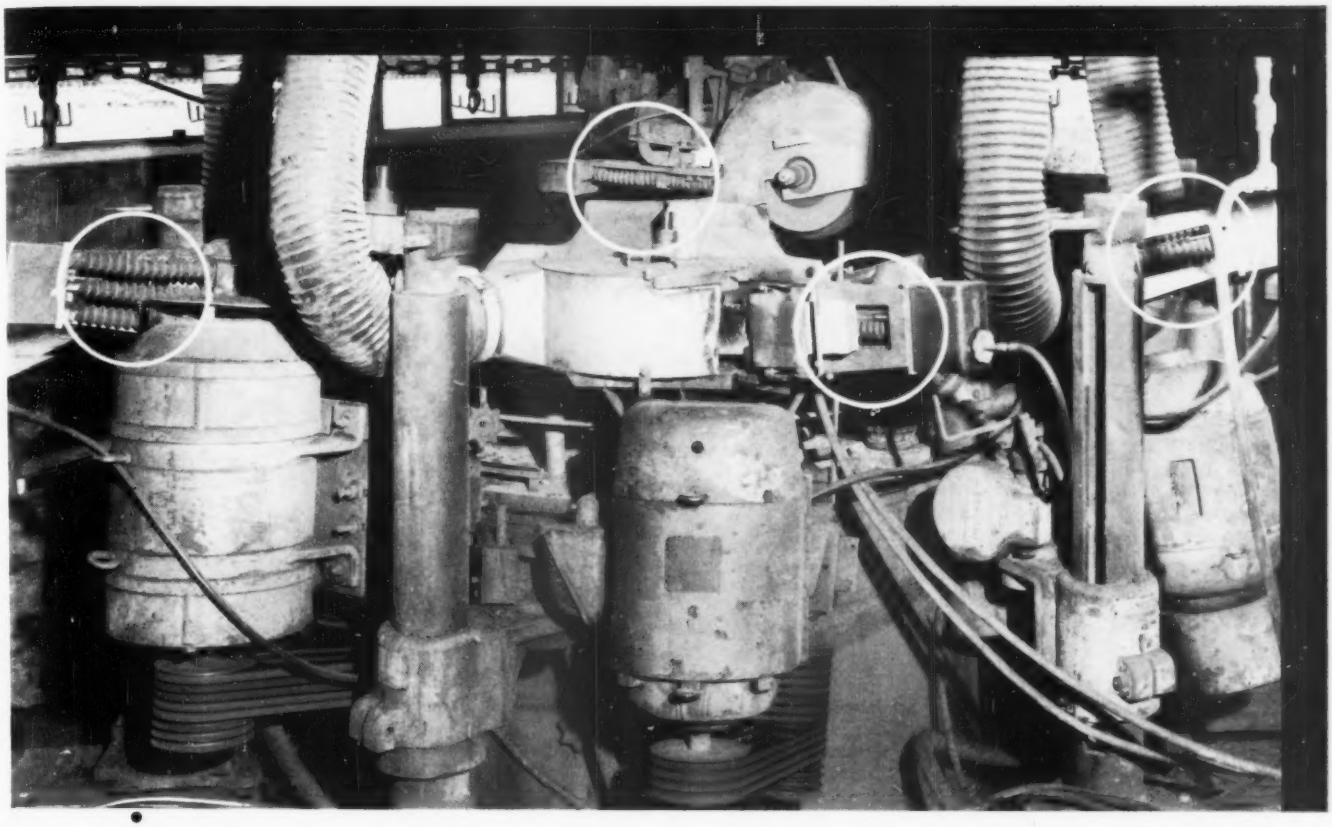

How Trim Manufacturer Cut Compound Costs in Half . . .

A prominent Detroit automotive manufacturer recently installed several Nankervis Automatic Compound Applicators for a trial period on one of their automatic trim buffing lines. After running an extensive series of tests — both on quality and quantity — they came up with these amazing results:

	SPRAY	BAR
COMPOUND USED	105 pounds	107 pounds
COMPOUND COST	$183.74 (.17½ x 105)	$176.55 (.16½ x 107)
NO. OF PIECES BUFFED	12,600	32,000
COST PER PIECE	$.0145 each	$.0055 each

Bar compound, automatically applied, doubled the number of pieces that could be buffed with the same amount of compound, cutting costs in half! Too good to be true? Conditions too ideal? Maybe. But the proof lies in the fact that now all their automatics use bar compound and Nankervis Applicators — saving dollars every minute of operation.

Sound interesting?

If it does, then why don't you too arrange for a trial in your plant. It won't cost you a cent. You conduct the test and you be the judge.

Write today for information about a trial in your plant. *George L. Nankervis Company, 15300 Fullerton Avenue, Detroit 27, Michigan.*

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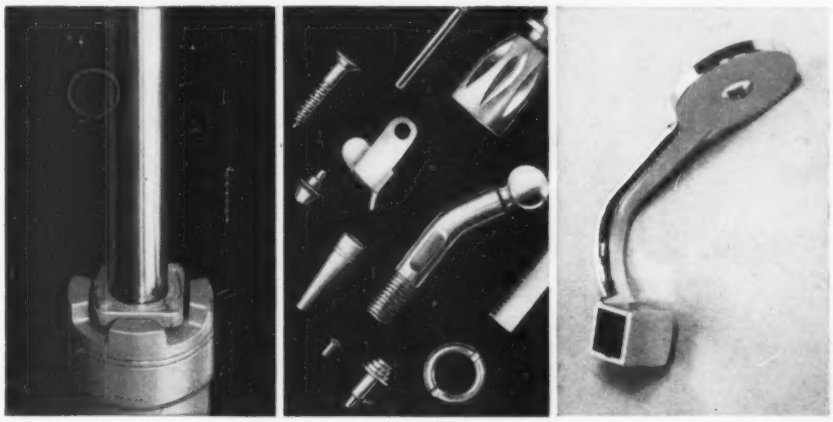
Equipment and Supplies for the Metal Finishing Industry

Chromium plating goes "specialized"

Deposits and bath characteristics matched to different needs



Chromium plating can be matched to different production and deposit requirements. Examples: (Left) Hydraulic rams get increased resistance to corrosion with Crack-Free Chromium. (Center) Quality is assured on barrel plated small parts by a special SRHS Bath. (Right) Both operations and results are improved in decorative plating with SRHS Chromium.

Meeting today's demand for more automation and specialized production "tools," M&T offers a *line* of processes to satisfy any chromium plating need. "Chromium is chromium" cannot be considered an accurate statement any longer. Chromium can differ in the *way* it is deposited and in *nature* of the deposit.

THE DIFFERENCES

Unichrome Crack-Free Chromium is a new type of *ductile* deposit in that it is free from the cracks riddling ordinary chromium. It affords more corrosion protection, reduces nickel need. It also withstands thermal shock better, and improves wear resistance. Thus, it is being used where electrodeposits formerly proved inadequate. Crack-Free Chromium, like all other Metal & Thermit chromium solutions, is self-regulated or "automated."

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The SRHS line offers a number of different solutions with varied operating characteristics. This selection makes possible exact cost-reducing and quality-improving matches between plating solution and production requirements. Developed especially for barrel chromium plating, one bath in the group assures lower cost high quality finishes on volumes of small parts.

All a plant needs is a tank and electrical service. Metal & Thermit can round out the installation with experienced technical aid and the only complete line of processes and equipment for the requirements.

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Immersion heater uses tough tantalum

An advanced type of electric immersion heater developed by M&T uses an acidproof tantalum tube to protect the heating element, promote good heat transfer. This tantalum sheath eliminates cracking such as may be encountered with brittle quartz heaters. Thermostatically controlled, the unit is rated at 5 KW, develops 17,000 Btu/hr — enough heat to raise 100 gallons of water 20°F per hour.

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Metal Finishing

POLISHING AND BUFFING · BARREL FINISHING · CLEANING
PLATING · ANODIZING · RUST PROOFING · LACQUERING & ENAMELING

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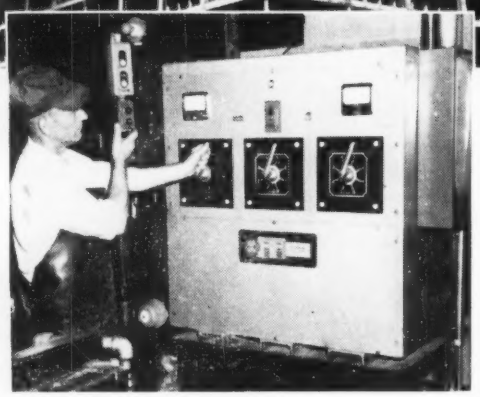

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ESTABLISHED 1903 VOLUME 55 • NUMBER 12 • DECEMBER, 1957

Year End Thoughts

It seems like only yesterday we were putting on paper our year-end comments, but a whole year has passed and the holiday season is now rolling around again, the season when the editor makes it a practice to refrain from burdening his readers with complaints about the way things are done, both in and to our industry. Instead, we don the proverbial rose-colored glasses and then take another glance around. And, as usual, things really aren't as miserable as the reader might have been led to expect from some of our previous monthly effusions.

For the first time in a half-dozen years, suppliers are calling up and asking how much nickel the customer would like to order — at market price, no less! Also, we've heard rumors recently, below market price in a couple of instances. If nothing else, easing of the nickel situation would be sufficient cause to view the passing scene with grateful appreciation of our blessings. But, in addition, steel salesmen have stopped looking askance, anymore, when they are asked to please furnish plating-grade wire instead of what looked and plated like tie-wire; and copper is coming out of our ears already, figuratively speaking, of course.

The metal finisher has been having things a little easier in recent months, although we wish we could say as much for the boss, who still has to hurdle some formidable obstacles to his peace of mind, such as the increasing cost of doing business and poor collections, before he can enter into the spirit of the festive season. There is no question but that operating the finishing department is not the problem it presented a year ago. With anodes in the tanks, with sufficient salts in the solutions, and with supplies readily available whenever needed, the plater especially is rather well off. In any case, should some pessimist be considering taking issue with us, just remember that things could be worse — and have been, not so long ago.

Nathaniel Hall

Metal Finishing

Wishes You A Very Merry Christmas and A Happy and Prosperous New Year

Mechanical Springs — Materials, Finishes and Embrittlement

By Lester F. Spencer, *Finishing Engineer, West Allis, Wisconsin*

MECHANICAL springs are among the most frequently used component parts of assemblies in the manufacture of consumer goods. Contrary to its wide usage, there is a definite lack of knowledge as to the metallurgical characteristics of the various spring materials and their behavior pattern when submitted to those operational procedures such as heat treatment, descaling and electroplating. However, in a discussion such as this, it may be well to define the subject matter under consideration. Thus, mechanical springs may be defined as springs that are formed at room temperature to a desired shape, and which may or may not be subsequently heat treated to obtain the desired properties. The material form used may be as flats that are ⅛ inches or less in thickness, or as round wire that have a diameter of ½ inches or less.

Spring Materials

Since iron base alloys are used as the material for over 95 per cent of spring production, it may be well to consider the types that are available under this category. One of the frequently used materials obtained in wire form are the carbon steels which can be obtained from the mill either as a hard drawn, annealed or pre-tempered form. Within each of these divisions, the following comments regarding both usage and characteristics can be made. However, before a discussion of this phase is made, it should be realized that the choice of a spring material basically depends on its ability to carry a load, either tensional or in compression, and the ability of the material selected to carry this load under conditions of either heat, corrosion, or both.

The most inexpensive material available is hard drawn wire; the composition most widely employed being S.A.E. 1066. This material receives its spring properties through the medium of cold work, while its use is confined where the service conditions are moderate. This type of wire is characterized by a poor surface condition when compared to other types of spring wire that are available. The preferred hard drawn wire is music wire, which is particularly applicable for mechanical springs having wire diameters less than 0.028", although it is used with success up to ⅛" in diameter. The superiority of this material is due to the mill control given during cold drawing and patenting operations, and it is characterized by a relatively smooth surface and high tensile strengths.

Flat spring wire compositions are normally those carbon steels identified as SAE 1095, 1075 and 1064; the first type is always used in the pre-tempered condition, whereas, the latter two types can also be obtained in the annealed state. In the event that an annealed wire is required to obtain formability, SAE 1075 is the preferred since more uniform results can be obtained in the subsequent heat treatment operation required to obtain the desired properties. It has been stated[6] that springs over 1 inch wide and 1/16 inch flat should be made from SAE 1075. It should be realized that the formability of pre-tempered wire is less than that obtained in the annealed state; this factor also being dependent upon the hardness of the material ordered. Thus, SAE 1095 flat spring wire can be obtained in three Rockwell hardness ranges — C41/C45, C45/C48, and C48/C51, the formability decreases as the hardness increases. These pre-tempered materials, which are used for thin clocksprings and simple forms, are sensitive to heat which renders them useless when the service condition exceeds 400°F.

Oil tempered round spring wire, usually SAE 1065, is one of the most commonly used materials and, although it has excellent properties, one drawback is its relatively poor surface which limits its use to non-critical functions. The better quality material is what the trade terms "Valve Spring Wire", which is also an oil tempered product made from SAE 1064. Its superiority can be traced to controlled processing to obtain a product that is free from surface imperfections, free of objectionable decarburization and exhibits a more uniform structure. As a result, this wire type is frequently specified for critical applications due to its consistent high endurance limits.

Where service conditions, either from a heat or a corrosion standpoint, exceed the performance anticipated for carbon steel spring materials, it is necessary to rely on alloy steel wire. One widely used material within this category is the chromium-vanadium spring steel which is usually identified as SAE 6150, this material being available either in the annealed or pre-tempered state. While the load carrying capacity of this material is equal to valve spring wire at room temperatures, its importance is in the proven ability to settle less at temperatures up to 425°F. In the event that this material is formed into springs in the annealed condition, the high hardenability of the chromium-vanadium composition may result in small cracks during hardening; this being especially true in small wire diameters.

TABLE 1

Nominal Composition of Spring Materials

Material	*Chemical Composition — Per Cent*															
Type	*C*	*Mn*	*Si*	*Cr*	*V*	*Ni*	*Mo*	*Al*	*Ti*	*Cb*	*P*	*Cu*	*Be*	*Sn*	*Fe*	*Others*
Carbon Steels																
SAE 1064	0.65	0.65	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	Rem.	.....
SAE 1065	0.65	0.75	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	Rem.	.....
SAE 1075	0.75	0.65	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	Rem.	.....
SAE 1095	0.95	0.40	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	Rem.	.....
Alloy Steels																
SAE 6150	0.50	0.78	0.30	0.90	0.15*	.....	.....	.....	.....	.....	.....	.....	.....	.....	Rem.	.....
SAE 9254	0.54	0.55	1.40	0.65	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	Rem.	.....
SAE 9260	0.60	0.85	2.00	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	Rem.	.....
AISI 302	0.08 to 0.20	2.0**	1.0**	17.0 to 19.0	.....	8.0 to 10.0	.....	.....	.....	.....	.....	.....	.....	.....	Rem.	.....
AISI 316	0.1**	2.0**	1.0**	16.0 to 18.0	.....	10.0 to 14.0	2.0 to 3.0	.....	.....	.....	.....	.....	.....	.....	Rem.	.....
AISI 431	0.2**	1.0**	1.0**	to 15.0	.....	1.25 to 2.50	.....	.....	.....	.....	.....	.....	.....	.....	Rem.	.....
"18-4-1"	0.73	.....	.....	4.0	1.0	.....	.....	.....	.....	.....	.....	.....	.....	.....	Rem.	W/18.0
"6-6-2"	0.84	.....	.....	4.0	2.0	.....	5.0	.....	.....	.....	.....	.....	.....	.....	Rem.	W/6.0
Copper Base Alloys																
Phosphor Bronze																
Grade A	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	95.0	.....	5.0	.....	.....
Grade C	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	92.0	.....	8.0	.....	.....
Silicon Bronze																
Type A	.....	1.0	3.0	.....	.....	.....	.....	.....	.....	.....	.....	96.0	.....	.....	.....	.....
Type B	.....	0.25	1.5	.....	.....	.....	.....	.....	.....	.....	.....	98.0	.....	.....	.....	.....
Beryllium Copper	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	98.0	.....	.....	.....	2.0/Be
Nickel Base Alloys																
Monel	0.3**	2.0**	0.5**	.....	.....	67.0	.....	0.05**	.....	.....	.....	Rem.	.....	.....	2.5**	.....
"K" Monel	0.25**	1.5**	1.0**	.....	.....	67.0	.....	3.0	.....	.....	.....	Rem.	.....	.....	2.0**	.....
Inconel	0.15**	1.0**	0.5**	15.5	.....	72.0*	.....	.....	.....	.....	.....	0.5**	.....	.....	10.0**	.....
Inconel "X"	0.08**	0.65	0.5**	15.0	.....	70.0*	.....	0.7	2.5	0.95	.....	0.2**	.....	.....	7.0	.....
Duranickel	0.3**	0.5**	1.0**	.....	.....	Rem.	.....	4.5	0.6**	.....	.....	0.3**	.....	.....	0.6**	.....
Permanickel	0.4**	0.5**	0.4**	.....	.....	Rem.	.....	.....	0.4	.....	.....	0.3**	.....	.....	0.6**	Mg/0.35
Elinvar	0.5 to 2.0	0.5 to 2.0	0.5 to 2.0	4.0 to 5.0	.....	33.0 to 35.0	.....	.....	.....	.....	.....	.....	.....	.....	53.0 to 61.0	W/1.0-3.0
Precipitation Hardening Stainless																
"17-7PH"	0.09**	1.0**	1.0**	17.0	.....	7.2	.....	1.0	.....	.....	.....	.....	.....	.....	Rem.	.....
Stainless "W"	0.12**	2.0**	1.0**	17.0	.....	7.0	.....	1.0**	1.0**	.....	.....	.....	.....	.....	Rem.	.....

*Minimum **Maximum Nominal values unless otherwise stated.

Both SAE 9254 (chromium-silicon) and SAE 9260 (silicon-manganese) analysis are used interchangeably where identical operating conditions are present. They are normally considered superior to the previously discussed SAE 6150 type since the load carrying capacity decreases at a less rapid rate under conditions combining high stress and heat. Both of these compositions are rather difficult to cold draw, which may result in a poorer surface than experienced with SAE 6150; however, their notch sensitivity is not as great.

The higher alloy types that can be used for service temperatures up to 800°F. would include the tungsten high speed analysis designated usually as "18-4-1" and the molybdenum type designated as "6-6-2." The selected service temperature is depended upon the stress required for the specific application.

The stainless steel composition, AISI type 302 which is usually known in the trade as "18-8" has also been used with varying success when cold drawn up to sizes of 5/16 inches in diameter. This material, when not grounded[6] or in electrical contact with copper alloys in the presence of halides, is very corrosion resistant. The performance of this material is apparently dependent upon individual mill practice; however, its use is generally limited to about 500°F. Although this is termed an austenitic material and is characterized by its non-magnetic properties, the cold drawing operation will result in magnetism, especially where the wire diameter or thickness decreases. Another composition that is frequently used is type 316 and 317; the 2.0 and 3.0% molybdenum addition within these analyses permits their use where corrosion resistance to salt water or electrolytic action is desired. Other compositions that have been used include type 431 and the newly developed precipitation hardening stainless designated as "17-7PH" and Stainless "W".

Brief mention will be made of various non-ferrous alloys that are used as spring materials. Within the copper family, phosphor bronze, silicon bronze and beryllium copper are the more frequently used. Phosphor bronze alloys receive their spring properties through the medium of cold work, whereas, beryllium copper is heat treatable. The latter type material is characterized by its high electrical conductivity which increases its usage in electronic equipment. Alloys used as spring materials within the nickel family will in-

clude Monel, Inconel, "K" Monel, Duranickel and Permanickel. All of these alloys are considered corrosion resistant; however, they are limited to some extent as to stress carrying ability at elevated temperatures. One of the recent developments is Elinvar, which is used for accurate scale springs, hairsprings, tuning forks, etc.; the outstanding characteristic being its constant modulus at temperatures ranging from –150 to 300°F. This material has limited load carrying ability but possesses excellent resistance to both oxidation and corrosion. Other alloys of this type include "Ni-Span-C".

Protective Coatings for Springs

One of the common causes of spring failure is corrosion. In this event, the three preventives that normally could be employed would either be (a) the use of a protective coating over the surface of the spring; (b) the use of a corrosion resistant material; or, (c) the removal of the corrosive enviroment. The breakage of springs attributed to the corrosive enviroment is particularly objectionable since any weakening of the load carrying capacity of the spring is difficult to detect and, when corrosive attack does begin, the resultant failure may be surprisingly sudden.

A protective coating is one of the most frequently used methods in protecting the surface of carbon and alloy spring materials; the reason being undoubtedly due to the fact that it is the least expensive. This coating may be either metallic or non-metallic in nature; the former method would embrace many of the standard electroplating coatings, whereas, the non-metallic coatings would include phosphate and black oxide coatings. It should be realized that, where electroplated coatings are employed, a calculated risk is taken in that the spring will not fail due to the age old phenomenon known as "Hydrogen Embrittlement". This phenomenon, which will be considered in detail, is frequently attributed to the plating operation; however, an analysis of failures would reveal that the preparatory treatment prior to the plating operation is the culprit; this being especially true when pickling procedures are employed.

It is a known fact that the quality of a protective coating is largely dependent on the effectiveness of the preparatory operations. Thus, contaminants such as grease and oils can be effectively removed by either solvent degreasing or by immersion in strong alkalies. The latter method is quite effective in solutions that carry current with the springs on the cathodic side; this method also removing some of the heat treat oxide. The oxide that forms during a heat treat operation, or rust, can be removed either by mechanical or chemical cleaning procedures. Mechanical cleaning would consist of the various shot blasting procedures; this includes those operations which would use abrasives of varying fineness, such as steel shot, steel grit, sand, etc. Vapor blasting, which is a relatively recent method that employs a very fine abrasive, will produce a smooth, semi-mat surface appearance which would serve as an excellent base for subsequent plating. Although steel shot is used to a considerable extent in the removal of scale on relatively large springs, it has one objection in that the high velocity of shot impingement will drive the oxide deeper into the surface. This will require additional chemical cleaning. In the event that chemical cleaning procedures are selected, care must be taken in the selection of the solutions so that embrittlement will not occur. This embrittlement, which is attributed to the absorption of hydrogen, is inevitable when strong acids are employed for scale removal even when many of the commercial inhibitors are employed.

Although an electrodeposited coating may be selected primarily on the basis of the protection that is obtained, there are quite a number of other factors which may influence the choice of coating. Thus, according to the ASM Committee on Electroplated Coatings,[3] the following factors have been listed which may influence the selection of an electroplated coating: (a) the surface appearance, which will stress the luster and permanency of the plated surface; (b) the effect of the coating on fatigue strength, which is particularly important with springs that are subjected to high stress during operation; (c) the effect of the enviroment that is in contact with the coating; (d) the galvanic action that may exist between the coating and the basis metal; (e) the electrical conductivity of the coating or of any oxides that may subsequently form; (f) those mechanical factors of fretting and general wear; (g) conversion coating possibilities; (h) the ease of application of the coating; and, (i) the general economics of the process.

Cadmium and Zinc Plate

The most frequently used electrodeposited coatings would include both cadmium and zinc, the choice of these two metals usually being on the basis of economics; however, there are other factors that may influence the choice of these two materials. Both of these coatings are anodic to steel, which means that full protection of the basis metal can be realized even though the plated coating may become nicked or scratched, thus exposing the basis metal to the atmosphere. Both cadmium and zinc will form a "white salt" corrosion product when in contact with oxygen, water vapor, or other chemicals that may be in the atmosphere; this insoluble corrosion product does not form a continuous film nor does it stop further corrosion of the electrodeposit. With respect to this corrosion, cadmium coatings are preferred over zinc coatings since a smaller amount of this objectionable "white salt" will form under identical conditions of exposure; this being particularly true when the plated articles are exposed to marine atmospheres.

Both cadmium and zinc coatings can be submitted to a subsequent "chromate" treatment which will inhibit the formation of the "white salt" corrosion product. In general, the plated material is immersed in a solution that contains chromic acid and catalytic agents which may either be mineral acids such as sulfuric or hydrochloric, or an organic acid such as formic acid. The immersion time is usually at a maximum of 30 seconds; this factor varying with the specific process employed, the bath temperature, and the condition of the plated surface. The coating, which is extremely thin, has low abrasion resistance; however, as a corro-

sion inhibitor, the protection that it gives is attributed to the inhibiting action of the soluble hexavalent chromium ion. This increase in corrosion resistance is very aptly indicated in Table II where the salt spray resistance of the zinc coating is 24 hours, whereas, the resistance with chromate coating is 48 hours. Chromate coatings can also serve quite adequately as a base for the bonding of paints.

Although both cadmium and zinc electroplated coatings may reduce the fatigue strength of the material due to that age old complaint "hydrogen embrittlement", it is generally conceded[3] that less hydrogen is evolved during cadmium plating. When cadmium plating is employed, alkaline plating baths are preferred because of their superior throwing power.

A precaution to observe, which has been established as a general practice throughout the plating industry, is to bake the springs at a temperature varying from 250 to 400°F. for a time period of one to three hours. The time will vary with the temperature; the higher the temperature, the shorter will be the time factor. The only limitation as to the hydrogen relief treatment is that the temperature is not too high to affect the hardness of the springs. Since spring materials have a relatively high hardness, usually over C34 and even as high as Rockwell C52, the springs should be given the hydrogen relief treatment as soon as possible after plating. In addition, careful handling is required up to the time of hydrogen relief treatment. When coiling operations in the forming of the springs are rather severe or, when there are doubts whether the cleaning procedure has also embrittled the springs, a hydrogen relief treatment is recommended.

An excellent example of a spring failure attributed to embrittlement by hydrogen has been cited by the ASM committee.[3] In this case, a cadmium plated compression spring, which operated under intermittent loading in a high temperature relief valve, failed shortly after being placed in service. The details of this problem, as given by the Committee are as follows:—

(A) Physical aspects of the spring included:—wire size, 0.343"; O. D. of spring, 2.0"; length of spring, 3.0"; and had six coils.

(B) Material — SAE 6150 (chromium-vanadium) composition which was used at a Rockwell hardness of C43 and was stress relieved immediately after coiling.

(C) The plating cycle consisted of:—(a) alkaline cleaning; (b) cold water rinsing; (c) cadmium plating with a coating of 0.0003"; (d) hot water rinse; and, (e) a relief treatment for hydrogen embrittlement by immersion in boiling water for a period of one-half hour.

The resultant failure of the spring was traced to hydrogen embrittlement, in spite of the relief treatment given which was though at first adequate. The conclusion derived was that failure would not have occurred if the relief treatment had been in the neighborhood of 375°F. for a period of at least one hour.

Another reason why cadmium is preferred over zinc coatings is that it will retain its initial appearances for a longer period of time. It also is feasible to give cadmium plate various colors which may be used to advantage, both in identification of parts and in increasing the salt spray resistance of the coating in a similar manner to that experienced with the chromate coatings. In this treatment, the plated surface is immersed in a solution which will form a porous oxide film. This is followed by a dip into a second solution that contains an absorbent and penetrating dye of the desired color.

TABLE II

Salt Spray Resistance of Zinc and Cadmium Electrodes[4]

(a) A Typical Specification for Zinc (U. S. Army Spec. 57-O-2C).

Types of Zinc Coatings

Class	*Thickness, Inches Minimum*
GS and GSC	0.0010
LS and LSC	0.0005
RS and RSC	0.00015

Note: the letter "C" denotes a chromate treatment.

Salt Spray Resistance (hours)

Class	*White Salts*	*Red Salts*
GS		72
LS		48
RS		24
GSC	24	96
LSC	24	72
RSC	24	48

(b) A Typical Specification for Cadmium Plating (Federal No. QQ-P-416).

Types of Cadmium Coatings

Type I -Without supplementary chromate treatment
Type II-With supplementary chromate treatment
Class A-0.0005 in. thick
Class B-0.0003 " "
Class C-0.0002 " "

Salt Spray Resistance (hours)

	Class	*Test Period for White Corrosion Products*	*Test Period for Corrosion of Basis Metal*
Type I	A	—	240
	B	—	192
	C	—	96
Type II	A	96	336
	B	96	288
	C	96	192

TABLE III

A Typical Specification for Phosphate and Black Oxide Coatings[4] (U. S. Specification 57-O-2C)

Type II Finish — Phosphate Coatings
- Class A — Phosphate coatings finished with non-drying petroleum oils containing corrosion inhibitors suitable for use on sliding or bearing surfaces.
- Class B — Phosphate coatings finished with a rust preventative suitably reduced for application and containing corrosion inhibitors.
- Class C — Phosphate coatings suitable for finishing with paint products.

Type III Finish — Black Oxide Coatings (Excluding Paint Products)
- Class A — Alkali Oxidizing Process
  - Grade 1 — Oxide coatings finished with non-drying petroleum oils.
  - Grade 2 — Oxide coatings finished with rust-inhibitor lacquer.
  - Grade 3 — Oxide coatings finished with synthetic resin coatings.
- Class B — Chromates
- Class C — Fused Salts

Salt Spray Resistance of above Coatings

	Before Applying the Specified Finishing Material	*After Applying the Specified Finishing Material*
Type II Finish		
Class A	1 hour	24 hours
Class B	2 hours	36 hours
Class C	No Test Required	150 hours*
Type III Finish		
Class A		
Grade 1	½ hour	2 hours
Grade 2	½ hour	16 hours
Grade 3	½ hour	24 hours
Class B	½ hour	24 hours
Class C	½ hour	24 hours

*This applies only to springs without sharp corners. Two coats of zinc chromate primer, for instance, will normally give a 72 hour salt spray resistance.

Composite Coatings

The use of a composite coating of cadmium and tin on a steel spring used as a contact bridge has been cited by the ASM Committee. The properties of this spring included the ability to resist wear, corrosion and the effects of electrical current. These springs are subjected to a mechanical cleaning cycle, after which a composite plate consisting of 0.25 mil cadmium and 0.25 mil of tin is applied, if the design is such that the rubbing parts of the contact can be masked readily. If this is not the case, the entire assembly is cleaned mechanically, plated with the cadmium-tin coating, and then the cadmium-tin plate is ground off the silver contacts. After plating is completed, a hydrogen relief treatment is necessary; a temperature of 330 to 340°F. for a period of one hour is recommended, provided this treatment does not alter the properties of the spring.

Composite coatings that may be used as a protective coating are combinations of copper, nickel, and chromium; the particular combination employed being dependent upon those factors stated previously. These composite coatings, although considered to be decorative coatings, do offer exceptional resistance to wear and corrosion particularly where chromium or nickel serves as the final coating.

Phosphate coatings are frequently used to increase resistance to corrosion, the susceptibility of phosphate coatings being considerably less than that experienced with electroplated coatings. When used as a base for paint, these coatings, which are about 0.0001 inch in thickness, will have a multiple function which, in accordance to Spring,[8] would include:—(a) direct improvement in adhesion due to the absorption of the paint into the pores of the phosphate coating, and the prevention of blister formation which may cause paint to flake; (b) by reducing undercutting corrosion; and, (c) reduction of in-process corrosion from the time they are cleaned and phosphated to actual painting. In its use in conjunction with a coating of wax, oil, or lacquer, a phosphate coating of about 0.0002″ will give some salt spray resistance at comparatively low costs. Black oxide coatings in conjunction with oils, lacquers, and synthetic resins will give limited salt spray resistance. Typical values for salt spray resistance are given in Table III.

One of the most economical coatings available for springs is painting; which serves both as a method of identification and as a corrosion preventive. Preliminary treatment such as phosphating is desirable.

(To be continued)

Science for the Coatings Technologist

Part VIII. Green Pigments

By E. S. Beck

This is the second and final installment of Mr. Beck's article on Green Pigments. The first half appeared in the November issue.—Ed.

Pigment Green B

This pigment is the Iron complex of alpha-nitroso beta-naphthol. It was a relatively unimportant pigment until the advent of water-based latex products. As most of these are alkaline, pigments for use in these enamels must show a high degree of alkali fastness. Pigment green B shows some useful properties for this use. It is very alkali-resistant, and quite stable in latex formulations.

The outdoor durability in masscolor is open to question. Some producers rate it as satisfactory, while others call it unsatisfactory. The author has no direct experience with the pigment in mass color as far as outdoor durability is concerned. All persons concerned are in agreement that the lightfastness is unsatisfactory in light tints.

The color is not a bright green, but shows a yellow-gray cast, definitely lacking in brightness. This, of course, seriously limits the use of the pigment. The coverage is extremely high, so that the fairly high price of the pigment is not so bad when considered in terms of coverage. The coverage is two or three times that of chrome green of the same depth while the price is about three times that of chrome green.

Pigment green B is non-toxic, making it a good choice for toy enamels (the lead content of chrome green would be objectionable here). It is fairly easy to disperse, and has a good resistance to flocculation. It is also good in acid resistance.

The tint tone is very yellowish and strong. While it is true the color is not very bright, it is not an unpleasing one. In fact, this type of color is sometimes specified by home decorators and color experts. For a summary of properties, pigment green B may be considered an alkali-proof green, of good coverage and reasonable cost, suitable for indoor use, and especially valuable for alkaline latex paints.

Compound Pigments

Considering both the success and the limitations of chrome green, it should not be remarkable that other combinations, replacing either the blue or both the blue and the yellow components of chrome green are on occasion offered to the user. In general, this class of compound pigment need detain us but a moment. The advantages obtained by the use of these mixtures can be gained readily by blending the individual pigments. So we have, in the major sense, covered these under the individual pigment discussions.

However, it will be of interest to mention a few of the compound green pigments which are available. Perhaps the most widely-used, and the most logical are the Phthalo Blue-Chrome Yellow types, sometimes known as Monarchrome or Thalo-Chrome. These are similar to chrome greens except that the colors are brighter and cleaner. The advantages shown are permanence of color in the package, improved light fastness, heat-resistance and alkali-resistance. Of course the price is also higher, running from two to three times that of chrome green, depending on the blue content.

A further improvement is shown by the mixture sometimes called Permanent Green, where phthalo blue and a permanent yellow toner are used. Here extreme durability, light-fastness, alkali-resistance and package stability are obtained. Of course, the price is rather high. Other combinations are ultramarine blue with yellow toner ("Forest Green") and ultramarine blue with chrome yellow. Both of these are attempts to overcome the poor alkali-resistance of chrome green. They do show better alkali-resistance, but at the price of poor acid-resistance, low coverage, low gloss (higher blue contents) and reduced durability.

No doubt, there are still other compound greens available, but these are all which have come to the author's knowledge.

Minor or Obsolete Green Pigments

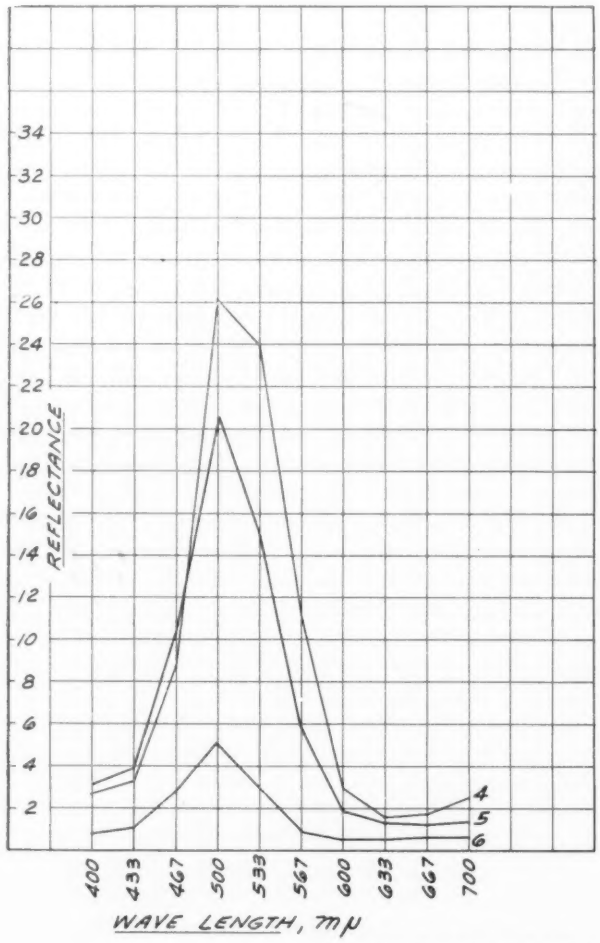
The pigments in this group are mentioned for the sake of completeness only, as all of them are out of current normal use. One occasionally sees the name of a member of this group used in some technical publication, but it is usually in a historic connection.

Paris Green. This famous, or infamous, material was once used fairly widely in paints and especially in wallpaper. It is also known as Emerald Green, and is the double salt of copper acetate and copper arsenite. The color is a very bright green, with a blue cast. It is still in limited use today, but only for its poisonous properties. It has some antifouling properties and also some

insecticidal values. For the latter usage, however, the organic insect poisons such a chlordan, DDT, and the like, are more useful.

Traditionally, there were many deaths, especially among children from Paris Green, long ago, when its use was widespread. Children were supposed to have died from the amount of arsenic in a small shred of wall-paper torn from the wall and chewed. One still hears occasionally, of deaths or illnesses abroad which are attributed to the presence of arsenic in paint, presumably as Paris green. The recent illness of Mrs. Luce, when ambassador to Italy, is a case in point. Her severe illness was blamed on arsenic poisoning from flakes of ceiling paint which had fallen onto her food. This paint was specifically reported in the papers as white, but perhaps there had been a layer of green beneath it.

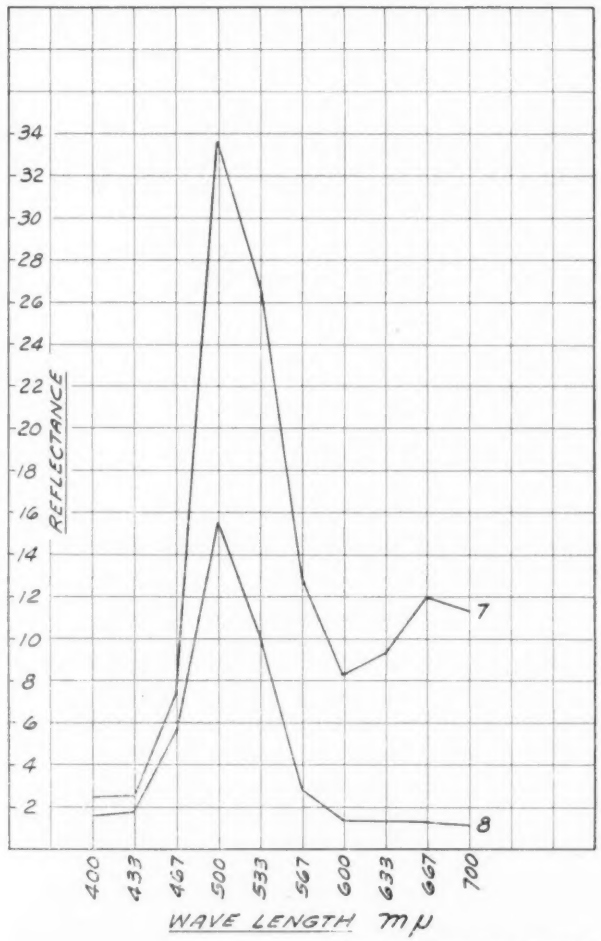
Zinc Green. An obsolete equivalent to chrome green, where zinc yellow was precipitated with the iron blue instead of chrome yellow. The greater exterior durability of zinc yellow is still occasionally utilized by formulators where called for, in admixture with iron blue or other pigments.



(*Courtesy Kentucky Color Co.*)

Figure 7. Three Curves of Phthalocyanine Green Mixtures. The same Phthalocyanine Green was used in all three of these examples. Curve 5 shows a 50-50 ratio of green to titanium dioxide. Curve 6 illustrates 10 parts of titanium dioxide to 90 parts of green. The general shape of the two curves is the same, but the 50-50 shows much lighter and cleaner.

Curve 4 is a three-way mixture of Phthalocyanine Green (23 parts) Shading Yellow (44 parts) and Titanium Dioxide (33 parts) The greater yellow component shows in the wider band in the yellow range. This mixture resembles chrome green in this respect.



(*Courtesy Kentucky Color Co.*)

Figure 8. Curves of two Greens made with Phthalocyanine Blue. Curve No. 7 is based on a mixture of Hansa Yellow, Phthalocyanine Blue, Titanium Dioxide and Red Iron Oxide. Notice the boost in the red range.

Curve No. 8 shows the reflectance of a mixture of Phthalocyanine Blue (20 parts) and Shading Yellow (80 parts). A rather bright, clean green is obtained.

Other obsolete green pigments are *Verdigris*, a complex copper carbonate or acetate; *Scheele's Green*, another arsenic compound; and *Cobalt Green*, a complex pigment containing zinc and cobalt.

Phthalocyanine Green

We have now arrived at the most modern, and in many respects, the most valuable of the green pigments. The pigment is chemically similar to phthalocyanine blue, except that the phthalocyanine molecule has been fully chlorinated. The properties are very much like those of phthalo blue, except better. The chlorination yields a much more stable compound. The phthalo green is practically flocculation-resistant and has no tendency to change in crystal form as does the phthalo blue (untreated).

It is even more light-fast than the blue and extremely stable to acids and alkalies. It is also very easy-to-disperse, at least by comparison with untreated forms of the blue. However, the additional processing makes the phthalo green more expensive than the blue by around

(*Continued on page* 66)

When to Use Solvent-Vapor Degreasing

By Dr. C. E. Kircher, *Detrex Chemical Industries, Inc., Detroit, Mich.*

IT is well known that no one cleaning process can handle all of the various metal cleaning jobs required by industry. This means an analysis must be made in each case to select the best cleaning process. Such an analysis should take into consideration: (1) the metal or metals to be cleaned; (2) the physical form and amount of work to be cleaned; (3) the type and amount of soils to be removed; (4) the degree of cleaning needed; (5) space requirements in the plant; (6) batch or continuous operation; (7) safety and health factors; (8) total cost to obtain the desired cleaning results.

This article is intended to give information necessary for the analysis of the application of solvent-vapor degreasing to specific metal cleaning jobs.

Metals to be Cleaned

Solvent-vapor degreasing is a cleaning process which uses a non-flammable solvent, usually trichlorethylene, to dissolve and wash soils from metal surfaces. An important feature of this process is that years of industrial experience have proven that all of the industrial metals can be processed in a degreaser. A degreaser, therefore, is not limited in its use to one or a few metals, but can be used with all of the commonly known ones. This means that, under proper conditions of operation, degreasing grade trichlorethylene does not attack metals being cleaned, nor is it harmed by contact with them.[1,2]

Amount and Form of Work to be Cleaned

Since solvent-vapor degreasing was developed and came into widespread use during a period of tremendous industrial expansion and mechanization of the metal working trades, it had to be broadly applicable to meet the needs of the times. Its success as a cleaning process rests solidly on the fact that it can be designed to handle any desired work load and all sizes and shapes of work. This is true because the same fundamental principles of operation can be built into any size or type or degreaser. Often, parts of intricate form and assemblies of dissimilar metals can best be cleaned to the desired degree by solvent-vapor degreasing. The specific cleaning requirements of each job are met by designing the cleaning cycle of the unit to give the desired results. The principles of degreaser design operation and maintenance have been presented in an number of articles.[3,4]

Soils to be Removed

Trichlorethylene, the most commonly used solvent in degreasers, cleans by dissolving and mechanically washing soils from surfaces. Therefore, to be effective as a cleaning process, the soil or soils to be removed should be soluble in trichlorethylene or easily displaced (if solids) by the washing action of the solvent flowing across the work. Since inorganic type soils, i.e., metal salts, oxides or compounds, are not, in general, soluble in trichlorethylene, degreasing is not an effective process for removing them. On the other hand, since trichlorethylene is an excellent solvent for most organic soils, i.e., hydrocarbon type materials, they can be quickly and thoroughly removed from metals by degreasing. Solid particles, such as metal dust or chips, held on a surface along with organic soils can be mechanically removed by the washing action of the solvent as it dissolves the organic binding agent. Spray impingement of solvent on the work is very effective in removing solid particles held on the surface along with buffing, drawing, and lubricating compounds. To generalize, solvent-vapor degreasing should be considered as a metal cleaning process when the soils involved are readily soluble in trichlorethylene and are not in themselves harmful to the solvent. This brings up the question, "What materials are harmful to the solvent?" The answer to this rests on a knowledge of the properties of trichlorethylene and the type of stabilizers used commercially in degreasing grade solvents. This information has been given, in some detail, in a recent ASTM publication.[5] Briefly summarized, the stability of the solvent is favored by keeping it in an alkaline condition. This can be determined by titration or pH measurement. Strongly acidic materials, i.e., inorganic acids or acid salts, should be kept out of a degreaser as they deplete the acid acceptor stabilizer present and can cause the solvent to become acid. This is an undesirable condition for the solvent, the degreaser, and the work being cleaned. As a rough guide, soils which, when shaken with neutral water, lower the pH of the water below 5.5, might have an adverse effect on trichlorethylene if brought into a degreaser. In contrast, organic soils which are neutral or slightly alkaline in nature are well suited for removal from metals by degreasing. Since, in general, these are the types of soils encountered in metal working operations, it is obvious that solvent-vapor degreasing has wide potential application as a cleaning process.

It must be pointed out that strong alkaline materials, such as sodium hydroxide and cyanide, and strong oxidizing chemicals are detrimental to trichlorethylene and should not be brought into contact with it. Trichlorethylene has become the chief solvent used in degreasing because of its satisfactory performance over a period of twenty years. Since there are other chlorohydrocarbons that are not as stable as

trichlorethylene when used in degreasers, some care must be taken to prevent such solvents from being added to trichlorethylene in degreasers.

Degree of Cleaning Required

The required degree of soil removal varies with each job and forms an important consideration in selecting a cleaning process. Other factors being favorable, solvent-vapor degreasing can usually be adapted to give the desired cleaning results by proper selection of what is called the "cleaning cycle." This means the specific sequence in which the work is contacted by solvent in vapor or liquid form and the type of mechanical action used. A description of the more widely used industrial cleaning cycles and applications of them can be found in the literature.[6]

It is relatively easy to determine, by small scale experiments, what cleaning cycle should be used for a particular job to obtain the desired results. This is a valuable feature of solvent-vapor degreasing and permits the equipment to be "tailored" for a specific job at little or no extra design cost. Investigation often reveals that one of the standard stock degreasers can be used to give completely satisfactory results for the application being considered.

A most important and valuable new development in the field of solvent-vapor degreasing is the ability to obtain exceptional cleaning results, where required, by the application of ultrasonic energy as a cleaning aid. With this new tool it is possible to realize a degree of soil removal from metal parts not previously attainable on a production scale.[7,8,9] Both high and low frequency acoustic energy can be used. The proper choice in each case depends on the parts to be cleaned and the proposed method of handling. Actual tests form the only reliable basis for deciding what frequency will produce the best results in a given case.

Space Requirements

Quite often, an important or limiting factor in choosing a cleaning process is the space required or available for the operation. This is particularly true when adding cleaning steps to existing production line operations. Since building space is valuable and represents one of the indirect costs of operation, a cleaning process requiring minimum volume or floor space is desirable. The ability to design the required cleaning process to fit into limited space is often a consideration favoring solvent-vapor degreasing. It is not surprising that this process uses less space in those cases where it is necessary for the cleaned work to leave "warm and dry", since this is inherent in the process. Where a separate drying step is necessary after other cleaning operations, this means more equipment, more building space and added operating costs.

Batch or Continuous Operation

The amount of, and the type of work to be cleaned usually determines whether batch or continuous operation should be used. It is, therefore, important in evaluating cleaning processes to determine if they function equally well in batch or continuous service. Solvent-vapor degreasing is somewhat unique in this respect since, when properly applied, essentially the same cleaning results can be obtained from either operation. The reason for this is that the usual organic soils involved are readily soluble in trichlorethylene, and the rate of soil removal is rapid. The nature of solvent-vapor degreasing is such that, when properly applied, it does an effective cleaning job quickly. Another reason why equally good results can be obtained in batch or continuous equipment is that, in either case, equivalent operating conditions can be established and maintained. Irrespective of the type of operation used, it is not necessary to relax standards or ease up on quality control.

Safety and Health Factors

Except for carelessness or situations which are not subject to control, it is generally recognized that industrial accidents stem from incomplete or inadequate control of process variables. The better the control, the less chance there is for injury to personnel or equipment. This principle applies to solvent-vapor degreasing and was recognized from the start as being a salient factor in the successful commercialization of the process. A very real difference between so-called "cold" solvent cleaning and "solvent-vapor degreasing" is that the latter process is a controlled operation, while the former is not. When properly designed and operated, the following important variables are regulated in a degreaser: (1) rate of vapor generation; (2) rate of vapor condensation; (3) vapor height in the machine; (4) work through-put; (5) solvent losses; (6) safe operator conditions. Years of industrial use and thousands of operating degreasers give testimony that the process can be adequately controlled to give safe and satisfactory performance.[10,11,12]

Cost Analysis

All too often in estimating and comparing the costs of cleaning processes partial rather than total costs are considered. This can lead to completely false conclusions as has been pointed out in the literature.[13,14] Any operating process requires building space, equipment, utilities, materials, operating and maintenance labor, supervision, etc. These items contribute to total operating cost either as direct or allocated charges. The most economical cleaning process is the one which gives the desired cleaning result at the lowest total cost. Comparing only the relative chemical costs, or utility costs, or other individual items, can be enlightening and helpful but falls short of giving the true overall cost picture. It has been pointed out that, while the cost of solvent for metal degreasing is important, the other charges are relatively low so that the total cost to operate makes it attractive and competitive when compared to other processes giving comparable cleaning results. It should be kept in mind that it is neither sound nor accurate to categorically rate cleaning processes irrespective of the job to be done. For example, the statement has been made, "Solvent degreasing is a costly cleaning process." A closer study of actual results, such as uniformity of cleaning, flexibitity of operation, rejects, etc., often reveals that very real sav-

(*Continued on page* 66)

Cutting Costs with Abrasive Belts and Abrasive Belt Machines

By Thomas J. Reid, *Abrasive Engineer, Coated Abrasive Division, The Carborundum Company, Niagara Falls, N. Y.*

WITH sound methods analysis and the proper coated abrasive belts and abrasive belt machinery to do the job, many manufacturers can substantially increase production and up-grade quality while saving money. This treatment offers a few examples to illustrate the value of the proper use of coated abrasive products.

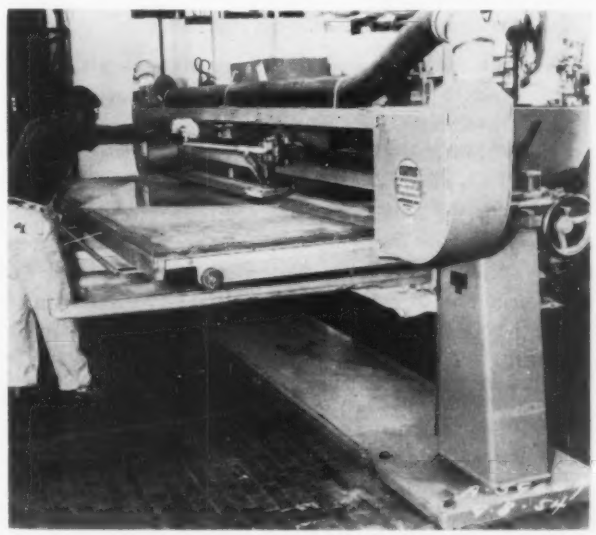
Stainless steel fabricators buy sheets finish-ground and polished to give the desired utility and eye appeal; yet, this finish is inevitably marred and scratched during fabrication. Although these marks can be sanded and blended by reciprocating sanders, pneumatic drums on portable tools, and by hand sanding, it is a time-consuming, tedious job, and it is very difficult to get a well-blended finish. If there are reasonably large flat surfaces, they can be refinished on a woodworking type stroke or hand block sander in a fraction of the time - and a highly skilled operator is not required.

This method can be used to good advantages by manufacturers of stainless steel doors, restaurant and hospital equipment, and similar products. The average stainless steel door can be finished in approximately 3 minutes per side - depending upon equipment used and the design of the door. The finish will be almost identical to, and will blend in with that produced at the mill. This compares with the 10 minutes and up usually taken to finish a side by the portable tool and hand sanding method. Machinery cost can vary from approximately $1,200 for a handblock sander to $4,000 for a hydraulic automatic stroke sander. An industrial cloth belt, coated with aluminum oxide, is usually used for this work. For easier blending and a better appearance, either a low-melting point grease-stick lubricant, or a sulfur-base oil should be used.

Welds on fabricated sections can be cut down and smoothed by hand-blocking with an industial cloth belt. A common tendency on this operation is to use a very coarse grit belt to get speedy removal of the weld. Generally, this is false economy because additional grinding and polishing will be necessary to eliminate the coarse scratch pattern and achieve a smooth blend. By cutting welds with a belt not more than one or two grit sizes coarser than the belt used for finishing and blending, this difficulty will be avoided. For example, 120 grit aluminum oxide belts are quite popular for blending with 100 grit stainless steel mill finish. By using 100 or 80 grit belts to cut the weld down, no difficulty will be experienced in getting a smooth blend. In many cases, the same belt can be used for both operations and belt changes are eliminated.

This type of equipment is also excellent for the sanding of flush metallic doors prior to painting. Any dimples from spot welding are easily and quickly smoothed by hand-blocking. By using a cloth belt which is flexible and resistant to snagging and tearing, the edges of the doors can be smoothed and rounded during this operation. The entire surface is stroke-sanded to smooth appearance, in preparation for painting, after the application of metallic putty to fill the low spots. A belt coated with silicon carbide abrasive grain is usually best for this operation, because most of the putty consists of a resin and the work is done without a lubricant. The operation takes only a fraction of the time necesary to do the same job with other methods - and requires only one operator. Undoubtedly, this method would do equally well on many other metal finishing jobs of a similar nature.

For manufacturers who have the problem of deburring, grinding, or polishing numerous small parts, a conveyor belt type machine, will easily do an excellent, high production job without the necessity of a skilled operator. This machine can be used with either a rubber or abrasive conveyor belt to carry the parts through. Hoppers can be fitted to these versatile machines so that, in many cases, thousands of parts per day can be finished. Two machines can be arranged in tandem with a turnover device so both sides of a flat part can be finished in one operation. For irregularly



(Courtesy Curtis Machine Corp., Jamestown, N. Y.)

Deburring large aluminum stampings at Glenn L. Martin Co., Baltimore, Md.

shaped parts, fixtures can be made to carry parts along the conveyor belt or a series of simple jigs can be made a part of the conveyor belt. Frequently, a series of cleats is all that is needed. All sorts of punched, stamped, or cast parts, such as typewriter and camera components, spoon blanks, and meter and valve parts, are readily finished or deburred on these machines. They are particularly suited to those operations requiring the clean removal of a burr without the rounding-off of the edge, such as in normally encountered in tumbling operations. These machines are also available as wet grinders if heat effects are undesirable.

More and more tubing of stainless steel, aluminum, and other metals is being used, especially in such areas as the furniture trade. The surface of tubing is very susceptible to scratching during shipment and storage, but it can be quickly and economically refinished with a centerless abrasive belt polisher, or a centerless polishing attachment for a backstand. In many cases, the manufacturer can save money by buying a coarser finish tubing and refinishing it to his own requirements. Centerless belt polishing does not require a skilled operator and it is an economical operation; costs frequently are only a fraction of a cent per foot for small diameter tubes. Centerless belt polishers are built in sizes that will handle tubes up to, and including, 9" diameter. They can also be arranged in tandem to do roughing and finishing in one pass. A lubricant is advised on such metals as stainless steel, aluminum, and brass. The abrasives used vary with the job but, in general, aluminum oxide coated belts are used for stainless and other steels while silicon carbide is used on non-ferrous applications.

These completely different operations are but three examples of the many ways coated abrasives and machine methods can economically solve production problems. There is no doubt that there are many operations which can be done faster, better, or at lower cost with coated abrasives.

GREEN PIGMENTS

(*Continued from page* 62)

20%. The covering and tinting power are also lower than those of the phthalo blue. Consequently, it is a distinctly expensive pigment to use, even in comparison with phthalo blue, which is far from cheap itself.

Thus, wherever possible, economy would dictate that where phthalo type properties are required in a green, the phthalo blue be used, and blended with an appropriate yellow. Where the very best in durability and light-fastness are required, the phthalo green should be used; where a little less than the best can be tolerated, the phthalo blue is permissable.

The color of phthalo green is extremely clean and bright. It is not used in paints in mass tone because the pigment is quite transparent, and because it develops a bad bronziness on exposure. In tints, however, it is very valuable. It can be produced in two somewhat different color types: yellowish and bluish. Both are extremely clean, bright, and brilliant toning pigments. Where certain extremely bright, clean green tints are required, it is often not possible to obtain them with phthalo blue and yellow combinations because of the reduced brilliance.

The heat-resistance of phthalo green is exceptionally good. It does not bleed even in lacquer solvents. It is non-flooding. If it were not for its price, which is 5 or 6 times that of chrome green, allowing for coverage, phthalo green would be the green pigment par excellence, except, of course, for mass tones, where the development of bronze is a bad drawback.

This matter of the cost of phthalo green can be something quite significant. Some companies purchase this item in flushed form for greater convenience in handling, and to take advantage of the increased color development flushing contributes. This flushed green can run easily $25 per gallon. A few 5-gal pails placed in the shading department can cost more than all the other colors put together. If these are used indiscriminately (and they sometimes are) the cost of shading can run up to extremely high levels. If phthalo green is used to shade a batch, without its cost being calculated in the formula, the raw material cost of the product can go up as much as 50c a gallon with ease. Some firms merely add on a flat shading charge without regard to materials used. Where phthalo green is used as a shading pigment, caution is recommended.

To summarize, phthalo green is an excellent all-around pigment except for mass tone; possessing good durability, light-fastness, stability, heat-, acid-, and alkali-resistance; with a very brilliant color; but it is high in cost.

SOLVENT VAPOR DEGREASING

(*Continued from page* 64)

ings can be realized by the proper use of this process in a wide variety of metal cleaning jobs.

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METAL SPRAYING — Development and Application

By S. J. Oechsle, Jr., *Protective Coatings Div., Metalweld, Inc., Philadelphia, Pa.*

THE idea of spraying an atomized stream of molten metal upon a surface to produce a metallic coating first occurred to *Dr. M. H. Schoop* of Zurich, Switzerland in 1909. After considerable experimental work, Dr. Schoop developed a stationary metal spraying machine which successfully produced an adherent coating when the object to be coated was held in the spray of the atomized metal. The original patents issued in Switzerland and Germany were dated between 1908 and 1910. Later, in order to have the advantage of portability, the powder gun, into which powdered metal was fed, was developed. This gun was limited to the use of metal which could be prepared in a powdered form. In 1912 Dr. Schoop developed a gun for spraying wire and formed a company in Germany about the time of World War I for the purpose of manufacture.

In the early 1920's *Richard Binder* of Philadelphia saw one of the guns that had been imported from Germany and was so impressed that he made a trip abroad to secure the rights to sell it in this country. After arranging a franchise and selling a few of the guns, the German company developed financial difficulties. Mr. Binder secured backing and bought controlling interest in the company which operated under the name of the Metals Coating Co. of America in Philadelphia. This company actively engaged in making the guns in the German plant and selling them in America until 1932 when the German operation again was shut down for financial reasons. About the same time, the first American made metalizing gun was manufactured in California and, between the years of 1932 and 1950, numerous other manufacturers in America developed and marketed metal spraying guns of various descriptions.

Most of these lasted a short time, with only a few surviving. Today, there are several excellent metalizing guns manufactured in this country. These are considered superior to the European guns and a great deal of development and research has been carried on by the American companies.

During the development stages, metals were sprayed in liquid, powder, and wire form. The wire gun proved to be the fastest, most flexible and economical for general use because of the ease of control, greater efficiency, and because commercial wire of all types could be obtained easily.

In the beginning or development stage of any equipment or process, sales promotion often oversteps the bounds of technical development and this happened in the metal spraying process. In the early stages many mistakes were made both in specifying and applying metalized coatings and, in many areas, the process gained a very bad reputation. Later, the manufacturers and users of metalizing equipment learned more about the process and how and when to use it to the best advantage. They learned that all sprayed coatings were inherently porous; however, they discovered that porosity was an advantage in many instances, such as absorbing and holding oil for lubricating purposes and obtaining better adhesion for a subsequent organic coating.

Still later, the American Welding Society (1944) organized a committee to promote metalizing, establish standards for design and manufacutring practices, inspection, and testing, and to create definition symbols and up-to-date bulletins on metalizing practices. They are presently conducting tests on some 4,000 metalized steel plates located in various test sites in the country to determine over a twelve year period the value of zinc and aluminum metalizing for rural, industrial, and sea atmosphere, and submerged in fresh and salt water. The tests have been running for three years and results can be obtained from the American Welding Society.

In 1950 a group of metalizing contractors organized and drew up specifications for sprayed zinc and aluminum for the protection of steel against atmospheric and water corrosion. These specifications cover some twenty applications of sprayed metal that have proven

to be exceptionally good for specific conditions and are available to purchasers, engineers and specification writers.

Uses for Metalizing

The uses of metal spraying can be broken down into four major components: (1) machine element metalizing, (2) corrosion-contamination metalizing, (3) combination coatings, and (4) high-temperature coatings.

MACHINE ELEMENT REPAIR:

It is in the maintenance field that metalizing excels. Wear is a constant factor in moving machinery. Worn parts accelerate wear even further. With metalizing, these worn parts can be restored to their original size and made to operate like new. Anything that wears is a potential metalizing job.

A few examples of proven applications are the metalizing of all types of shafts and bearing and gland surfaces of motors, generators, turbines, centrifugal pumps, machine tools, rods and similar objects. Pistons and hydraulic rams, crank shafts, printing cylinders, drying drums, paper making rolls, and many other pieces of machinery and equipment can be resurfaced with metals that will outwear the original metal.

Production set-ups can be used whereby metalizing is applied to conserve critical materials or to produce a hard wearing or heat resistance surface. For example, metals like stainless steel, nickel, Monel or aluminum can be sprayed on carbon steel in desired areas only. Parts are rebuilt with no excessive application of heat. Consequently, there is no danger of warpage or crystallization of basis metal. A motor armature shaft, for instance, can be rebuilt with no damage to the windings. Cost of repair by metalizing is normally only a fraction of the replacement cost of the part or machine.

Metalizing of one small worn section may salvage a large expensive part. Journals or the packing gland sections of a shaft, metalized with carbon steel, stainless steel, nickel, etc., can be expected to give a service life of from two to five times that of the original. Increased hardness, corrosion resistance, and affinity for a lubricant are the basic reasons for this extended service life.

CORROSION-CONTAMINATION:

Metals such as zinc and aluminum, sprayed on steel structures to a thickness depending upon the service conditions will afford cathodic protection and eliminate the possibility or iron oxide penetrating the barrier to contaminate the product. It has been found that 8-10 mil thicknesses of sprayed zinc or aluminum offer continuous protection in certain environments with only about 1 or 2 mil dissipation from the sprayed metal in an eight year period. When there is a change from one product to another only warm, fresh water is required to clean the surfaces and this has no detrimental effect on the sprayed metal coating even though the coating is porous. Cathodic action during cleaning prevents rust from forming.

The surfaces of vessels which are used for one product service can be protected with certain other metals such as nickel, tin, or stainless steel. These metals form an inert barrier if organic liquids to be protected from contamination have no oxidizing effect on either the basis metal or the coating. Even though the coating is porous, certain specific solutions will impregnate the coating and prevent contamination and iron pick up. This is true when there is no water present or water or steam used in cleaning. As an example, ethylene oxide tank cars have been sprayed with stainless steel. When the product comes in contact with the steel base it polymerizes within the structure of the sprayed metal.

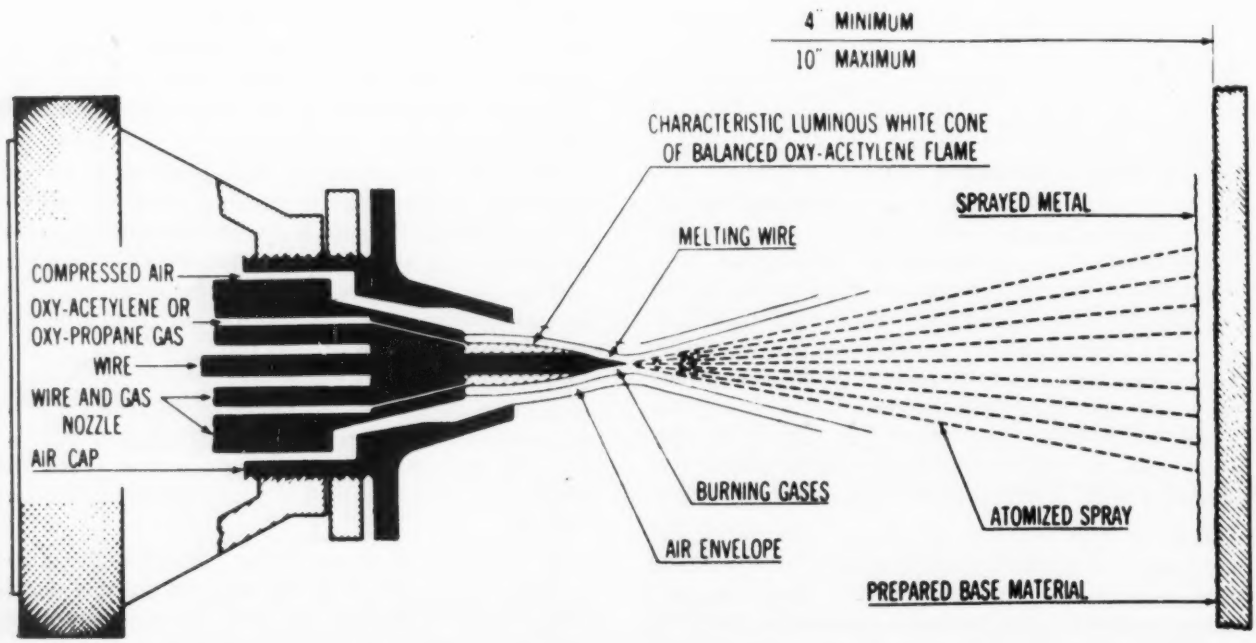


Fig. 1. Wire Spray Gun Nozzle Cross-Section.

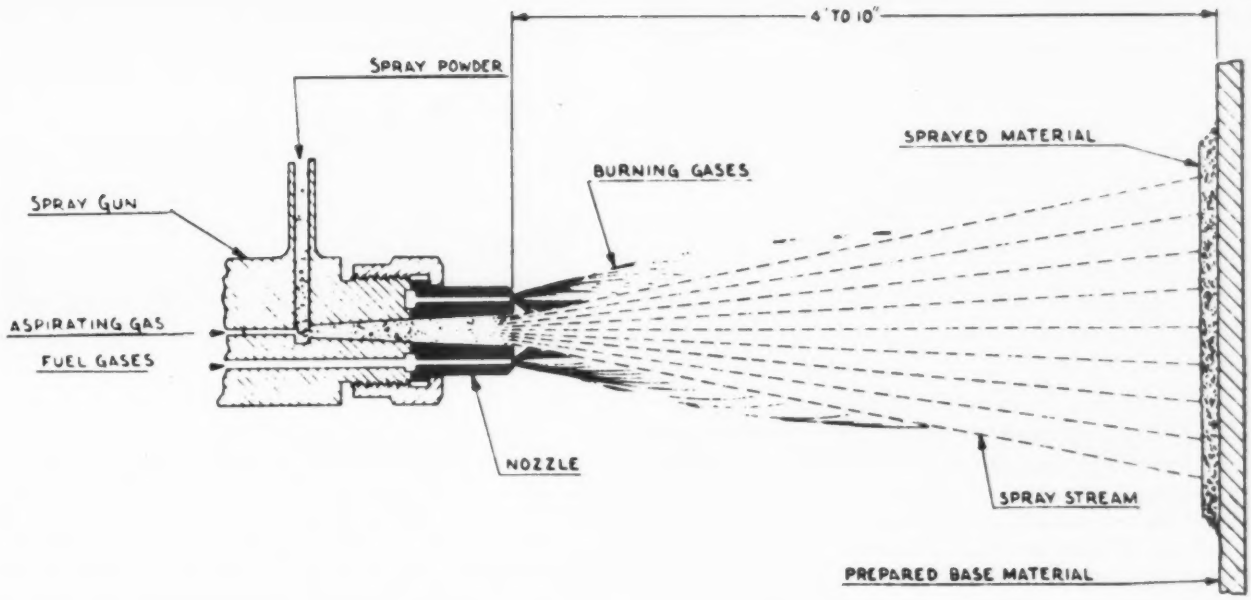


Fig. 2. Powder Spray Gun Nozzle Cross-Section.

This is an example of a combination coating. Semi-chemical digesters for the pulp and paper industry have been metalized with stainless steel. The theory is that, in the reaction, calcium sulphite is formed within the structure of the sprayed metal, which is another example of combination coating protection. These two are of a very special group and are not to be confused with the normal run of successful applications for corrosion-contamination protection. Excellent protection has been accomplished in storage tanks, shipping containers, barges and ship tanks, tank cars, food handling equipment and such products as food, sugar, liquid soap, glycerine, transparent lacquers, solvents, oils, meat products and neutral solutions.

It would be impossible to pass this section without some mention of the number of successful applications of bare sprayed metal coatings of zinc and aluminum for atmospheric and water corrosion. This type of application for the past 20 to 30 years has been giving, and is still giving, excellent protection on a variety of structures. A zinc coating applied to the interior surfaces of a water storage tank in 1934 cost approximately $1.00 per square foot of area. After 22 years, the cost is approximately 4½¢ per square foot per year of protection afforded. It is estimated that at least half of the original thickness of zinc remains so that an additional 15 years of protection can be anticipated, and, in the meantime, there is no loss of steel in the tank.

COMBINATION COATINGS:

When discussing combination coatings one must realize the difference in sprayed coatings that are cathodic to steel and those that are anodic. Aluminum and zinc will be considered first, since they are anodic to steel and are the only practical metals available for metalizing that protect steel cathodically. They are sacrificial coatings and their life or usefulness depends upon their environment. Sprayed coatings of these two metals are sometimes impregnated with a suitable resin in order to:

1. Extend service life by reducing dissipation.
2. To enhance the appearance.
3. A combination of 1 and 2.

As far back as 1933 coal barges on the Delaware River were sprayed with zinc and sealed with a marine paint. This combination coating proved so successful on the barges that the inspection period was increased from one to two years, which reduced the cost of maintenance considerably. Since the time of the original zinc spraying no shell plates have been replaced because of corrosion. Severe service of the sprayed metal has been in certain areas due to docking, abrasion from tugs, running through ice during the winter, and other hazards while operating on the Delaware. The barges have been maintained periodically by touching up the physically damaged areas with zinc when required at the haul-out and inspection period. After 20 years there is no loss of steel or corrosion on the barges.

Some years ago the Philadelphia Electric Company realized that their underground junction boxes for high voltage lines were corroding severely. All standard paint systems failed in less than one year because of the extreme humidity and partial immersion during heavy rain. This was exaggerated by the salt applied to the road during the winter season which flooded the manhole during the thaw. Several locations were chosen in May 1951 and an experimental lining of zinc and a vinyl system were applied. Five and one-half years have passed and the original units are still in excellent condition with no visible breakdown in the system.

As stated before, metalized coatings are porous and the porosity greatly increases the adhesion of a coating applied over the sprayed metal. The thinned organic coatings soak into the sprayed metal like a blotter and anchor themselves permanently to the surface. Metalizing eliminates underfilm corrosion and oxidation even though the film is broken. Sprayed zinc and aluminum protect against rust. The three primary causes for

coating failure — lose of adhesion, underfilm corrosion and osmotic blistering, are virtually eliminated. Vinyls, furanes, phenolics, epoxies, silicones, neoprene and chlorinated rubbers have been used successfully as sealers over sprayed metal, as well as air-dried, catalyzed, or baked coatings. Sprayed metal coatings with organic sealers can be applied to bridges, vessels, tanks of all kinds, steel pilings, ship hulls, superstructures and interior equipment, refrigeration equipment, underground conduits and fabricated steel. These coatings provide low yearly protection against severe industrial, rural, water (salt and fresh), and mild corrosive atmospheres.

We will now consider the metals that are cathodic to steel. In tracing the development of combination coatings, let's start with the situation of extended life of machine elements. It has been substantiated that a lubricant will soak into the pores of the sprayed metal and give a more adequate film than is possible with a solid metal part. Another situation that arose in the early days of metalizing was the problem of spraying high pressure hydraulic rams. It was found that the hydraulic fluid under pressure would penetrate the sprayed metal below the packing ring, travel under and through to the atmospheric side of the gland, and peel the sprayed metal off in large sections. Some mechanical changes were made and a sealing system developed using a linseed oil base. The finished product was so successful that these rams and others have been salvaged ever since. This was the first major step in the successful sealing of sprayed metal. In order to understand the combination coating, we must look carefully at the components. First, the characteristics of the metal spray — it will be realized that the bond between the sprayed metal and the basis metal is strictly mechanical and its strength depends on the type of surface preparation and the type of metal to be used. The selection of the spray metal is of prime importance. It must have maximum resistance to the proposed service conditions. The choice of the organic sealer is equally important. Through careful testing and elimination the organic with maximum economical resistance should be chosen. There have been many combinations using a variety of basis metal and sealers

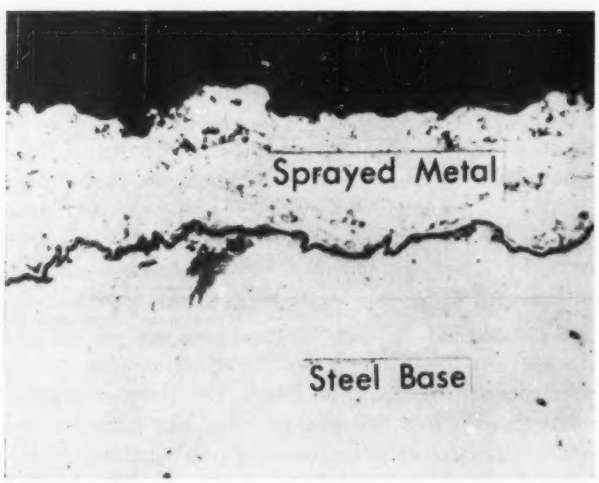


Fig. 3. Photomicrograph of sprayed steel base cross-section. Note mechanical bond to roughened base and rough sprayed surface which insures paint adhesion.

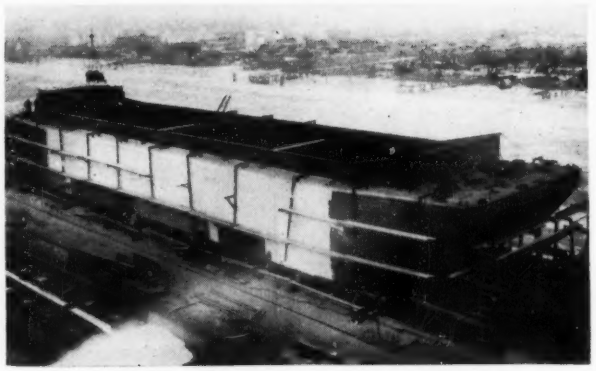


Fig. 4. Steel coal barge being zinc sprayed for corrosion prevention.

of the phenol, phenol-epoxy and epoxy and furane, both in the baking and chemically converted types. There are specific methods by which complete impregnation is accomplished. A problem presents itself in the use of chemically converted materials. It is important to consider the converting agent. Whether the agent is acid or alkaline will determine its compatibility with the basis metal. There have been many successful applications in a wide range of situations. One such system is composed of sprayed nickel impregnated with a heat cured phenol-epoxy operating in boiling hydrochloric acid contaminated with solvent.

An existing corroded tank was thoroughly blast cleaned and a 0.010" lining of nickel was impregnated with a non-toxic, chemically converted, phenol-epoxy resin. This unit has operated for three years without any sign of failure. Six additional similar units have been lined in the St. Louis area without experiencing failure. These tanks were hot water generators operating under severe conditions at a maximum 180°F. The longest service life of any previous lining was six months.

Most all of the applications point up the fact that there is an area within the range of corrosion problems that can be solved by the use of these combination systems. Many tests are being conducted to determine the exact advantage insofar as the chemical resistance of the resins, which seems to increase when combined with sprayed metal, and the temperature limitations which can directly affect the life of the film.

Summing up the advantages of the combination coating systems, we find as follows:

1. Increased corrosion protection.
2. Increased life expectancy of the lining by reason of its double protection.
3. Better resistance to mechanical damage. (Abrasion of the organic coating would still leave the protection of the impregnated sprayed metal.)
4. Higher temperature resistance.
5. Advantage of being able to use a low cost material of construction. For instances, stainless steel or nickel metalizing in place of all stainless steel or nickel tank.

HIGH TEMPERATURE PROTECTION:

In years past the commercial use of metalized heat treatment vessels and other parts exposed to heat corrosion increased so rapidly that today these processes

have become the accepted standard in many industries. They are used to prevent heat corrosion caused by the action of hot gases on iron and steel parts and copper-nickel alloys, and consist of thin coatings which are applied to iron or steel parts.

One process involves the application of a sprayed aluminum coating, the addition of a special paint type sealer and the subsequent heat treatment of the coated part. In this case, protection against heat corrosion is provided by the absorption of aluminum into the surface. Temperature ranges up to 1800°F.

Another process consists of a thin layer of sprayed nickel-chromium applied to an iron or steel part, a very thin layer of sprayed aluminum applied to the nickel-chromium coating, and finally a special paint type sealer applied on the outside. No heat treatment is necessary before the part is put into service. During the first heat the aluminum melts and is absorbed rapidly into the porous, sponge-like structure of the sprayed nickel-chromium alloy. Temperature range 2000°F. where sulphur gases are encountered.

Sprayed Powder Coatings

New developments in alloy and ceramic powder have already begun to extend the use of sprayed coatings. These new materials find service in wear, corrosion, and heat resistance fields.

There have been major problems to overcome in the development of spraying these materials. Rod or wire forms of alloy or ceramic were not available, the guns had a low spray speed and a low deposit efficiency, and greater tendency to oxidize the metal spray was also a fact which kept the powder system running a poor second at the time of development.

The new powder guns developed for the spraying of alloy and ceramic have corrected many of the old problems. Deposit efficiency is well above 90% and sufficient heat can be applied for spraying the high melting point materials like alumina and zirconia.

There are three basic groups into which materials can be divided when used in a powder gun:

SELF-FLUXING ALLOYS:

These are usually (but not always) fused after spraying. The term self-fluxing is used to describe

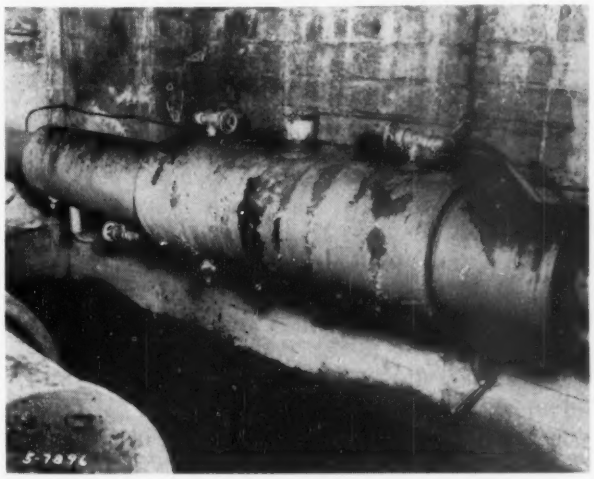


Fig. 5. View of underground high voltage junction box showing paint failure.

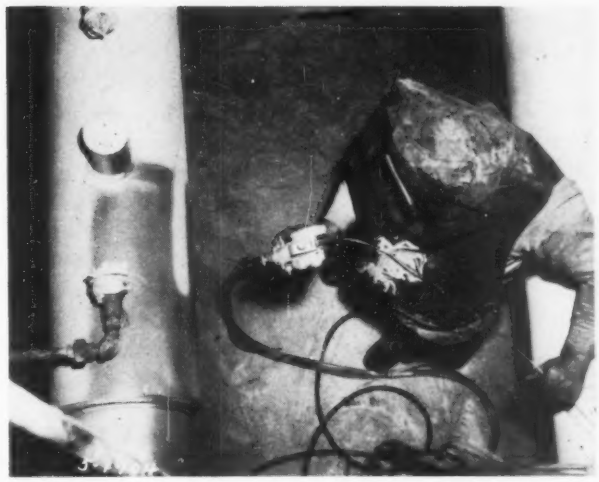


Fig. 6. Application of zinc coating to blast-cleaned junction box using hand-held wire gun.

alloys to which fluxing agents have been added. The fluxing elements commonly used with nickel based alloys are boron and silicon. The boro-silicate which results from the fusing operation dissolves oxides of iron, nickel, and chromium and promotes wetting and fusing of metal particles to each other and to the base. The amount of boron and silicon must be carefully controlled in these alloys since their physical properties depend to a critical extent on the boron-silicon content. Alloys of this type range in hardness from Rockwell C-30 to C-65. They posses excellent resistance to corrosion and heat oxidation. They have a very low coefficient of friction and resist wear and abrasion to a much greater extent than most other alloys of equal or greater hardness.

OXIDATION RESISTANT ALLOYS:

These are not fused after spraying, since alloys were developed for use without fusing after deposition. They are designed to resist the formation of oxide without the addition of self-fluxing agents. If materials which do not resist oxidation are used in the powder process, oxides form and are incorporated in the coatings to an objectionable degree. Oxidation-resistant alloys of this group include stainless steel, high chromium stainless steel, and a chromium-nickel alloy which has very high corrosion resistance properties.

These metals have superior physical properties when sprayed with the new powder gun, using fine powders and hydrogen as fuel gas. The coatings are finer and denser than can be obtained with the wire process.

CERAMICS:

Ceramics such as zirconia and alumina based materials are specially processed and graded for use as abrasion resistant thermal insulators. These have always been difficult to spray, due to their high melting point and low heat conductivity. When conventional powder guns, using compressed air, had been employed for spraying ceramics, the cooling effect in the air seriously reduced the thermal efficiency, with resulting poor deposit efficiency. The new powder gun sprays ceramic materials with a very high deposit efficiency, due to its design which eliminates the com-

(*Continued on page* 76)

PAINTING PROCESS SAFETY

By E. A. Zahn, *Finishes Consultant*

The following is an excerpt from the author's book, "Industrial Finishing and Common Sense," to be published shortly by Research Press, Inc., Dayton, Ohio.

IT is alright at times to say that safety is a funny thing or a joke but you may change your mind after you have seen a good sized industrial paint fire. It is certainly not a joke then. Quite apparently, no one is sufficiently safety minded except possibly those who make their living installing safety habits. In fact, no one can really understand just why so few serious industrial paint fires have really occurred. Many of our safety rules do not seem to make a great deal of sense to some, and they mean absolutely nothing to some others. Perhaps it would be a good idea to use some of Grandma's old remedy on these jokers. When Grandma caught us playing with matches, she lit one for us and let it burn our fingers. It was a very effective way to teach us considerable respect for fire. Of course a safety engineer wouldn't get very far trying to burn the workman's fingers today.

There is just no substitute for good housekeeping in a painting area so far as safety is concerned. You just can't do too much house cleaning. Yet fires have started in clean areas too. Many more of them have started in the sloppy areas. "No Smoking" signs impress some people. Others bump both of their heads on them, and with cigar in hand call the sign a physical hazard. These "No Smoking" signs are very necessary though because some people read them and comply readily. You can never have too many No Smoking signs. They shouldn't, however, be hung so as to put a man's eye out. Luminous red letters on a white background, conspicuously mounted, appear to be the most effective.

The woods are just full of daredevils who think that no smoking and other safety rules are purely ridiculous. Take, for example, a maintenance or a construction worker who's specialty is gas welding and cutting. When he learned that he could handle high voltage lines and climb to dizzy heights, he felt something like a circus daredevil. He believes that if he didn't get electrocuted and he didn't break his neck climbing around on girders, he doesn't need to worry about fires either. More paint fires have started from red hot metal from a welder's torch than any other single cause, except possibly smoking. Welders are human beings, and it should be possible to explain that hazard to them even though they have to do some other relatively risky and reckless work for a living.

Safety markings on the floor around a hazardous area indicating danger from smoking is a very good idea. In fact it is absolutely necessary. The safety rules should read that no smoking is permitted within twenty feet of the safety line because there are always those hourly paid workers who demand their full rights so far as smoking is concerned. They want to stand with one foot on the line when they smoke and they want to see the sparks fly when they snap their cigarettes on the floor. These are also the same ones who cup their cigarette in their hand, out of sight, while they walk right through a no smoking zone. It is one thing to be stupid about your own safety but it can justly be called malicious when you refuse to consider the safety of a fellow worker.

Probably most of us have heard about the guy who found out that you could throw a lit match into a pail of gasoline without starting a fire. To be real honest about it he was looked upon as quite a hero for quite some time. Then one day he demonstrated his talents for a visitor who turned out to be the district insurance inspector. He was extremely lucky in getting off by merely getting fired without notice. He could also have been blown through the roof which would have been a great deal faster, and as a matter of fact he could have taken several of his fellow workers with him.

The popular fire laws in industry, for some reason, appear to be like all other man-made laws. They appear

to be made to be broken by certain elements. If the law breakers really had something to gain, it might be understandable, but he hasn't. Furthermore, the fire law-breaker isn't necessarily the one who gets burned either. He is a worse hazard than all of the inflammable materials put together. For some ridiculous reason, he doesn't believe that the hazard is as serious as we sometimes make out. He doesn't want to be careless, he just doesn't believe in signs.

Do you remember the signs that say "All steel containers for solvent and paint must be grounded when in use"? That is one sign which is most often violated. The violator thinks that it is very funny when he goes around picking up a static load on his rubber soled shoes and then scares the daylights out of his fellow worker by touching him on the ear. That little spark snap that he hears, and sometimes sees, is all that is necessary to start a million dollar fire.

There are fires, and there are explosions, and often there is a combination of both of them. When they do happen, everybody loses and nobody gains a thing. The paint and the solvent material loss may very well be the smallest loss item of all. These can readily be replaced for a specific number of dollars within a very short time. That, however, is never the total loss.

Valuable equipment can be destroyed in a fire or an explosion. It costs more money than the paint, and if taken by surprise, it can take a long time to replace it. Some other industry with their own manufacturing time schedule gets involved when equipment has to be replaced.

Assuming that only the paint, solvent, and the equipment is destroyed, there is also a much greater loss yet to be considered. The loss of production, which in itself is the sole reason for being in business can be the greatest loss of all. This can be a staggering amount, and we would do well to think a lot more about it when we talk about rules for fire safety. For example, assume that an item in volume production of a thousand units a day, has a billing value of a hundred dollars a unit and a profit value of ten dollars a unit. A production tie-up of one week, which incidentally is a low estimate for fire shut-down, costs the manufacturer a billing loss of five hundred thousand dollars. The profit loss may look like only fifty thousand dollars, but add his shut-down and other losses, and then it will look entirely different.

Sometimes a manufacturer is sufficiently insured, and if not, has sufficient capital on hand to get back into business within a few weeks. But how about the workers who depend on this week's pay for next week's bread? This could be a catastrophy for many and it is particularly catastrophic when we realize that the fire may have been avoided by taking simple warning signs a little more seriously.

It certainly would be strange if, in an industrial paint fire, someone wasn't seriously burned, or even a few workers killed. Insurance in that case certainly plays its part but how about the families of the ones who did get burned or killed? There must be new and better ways in which workers can be made to realize that conscientious safety men have a good reason for every caution sign and every safety rule. Their information on which they act is based on accurate statistics and their actions and decisions are designed to protect both the manufacturer and the employe. The employe's job and his life are both at stake.

The employe most certainly has a responsibility with regard to fire and of which he is to benefit directly. The manufacturer, on the other hand, has responsibilities along much the same lines. He must consider process safety when selecting painting and other process methods.

Of the common methods of paint application, some are of course more hazardous than others. Protection against material, equipment, production losses, and against personal injury are all involved in painting.

In the case of hand spray painting, there are two potential hazards according to the past records. A spark can explode atomized material coming from the spray gun in an area where practically everything is inflammable. The accumulation of dry overspray in a spray booth and particularly in the exhaust stack is also a tremendous hazard. It is a hazard not only when the production line is moving, but it is a serious hazard during the normal clean-up time also. Hand spray installations require constant policing. In at least one case, the work hangers on the conveyor became sufficiently coated with paint so that they were insulated and no longer grounded. As the rubber soled operator reached to turn a part on the conveyor, a static spark started the fire.

In another case, during the regular vacation shut-down period, several operators were cleaning the concrete floor of the spray booth with solvent. One small nail in the heel of the shoe of one of the workmen caused a spark which cost a man his life. It very well could have been worse too since the exhaust stacks had just been vacated by two other workmen who had gone out to have a smoke.

In the case of electrostatic spraying, there is always a potential spark in the area where paint is being atomized. By safety rule, only authorized personnel are allowed inside of an electrostatic booth. This rule is quite often violated. There seems to be some attraction for some people to such areas particularly when no one has been electrocuted or badly burned recently. The sign "No Admittance," "High Voltage" is there for a purpose and it must be respected at all times by all people. People need to learn to overcome their curiosity concerning such highly developed specialties.

In the case of conveyorized dipping, we could really visualize large volume fires. The quantity of paint material in process is greater than with any other method. Tanks containing five thousand gallons of paint are not at all uncommon and often exist in an open room area. If each person in contact with such an installation could possibly realize the existing ideal explosive mixture at the interface between the liquid paint and the surrounding atmosphere, they would keep a little greater distance between themselevs and the tanks, particularly when they are passing through with a cupped cigarette in their hand.

Flow coating is at least an approach to greater painting safety because no operators have or need access to the equipment interior during the operation of it. The accompanying tunnels are slightly hazardous since an amount of solvent vapor and air mixture is necessary

for film levelling. Accurate instrumentation in this case contributes considerably to safety and as in all other types of industrial painting, only trained authorized personnel should ever be allowed in the area.

Automatic spraying is not the answer to safety either except as it reduces the number of workmen in the exposed area. It produces exactly the same explosive, inflammable mixtures as hand spraying does.

The one item which is often most conspicuous by its absence in painting and in paint storage areas is common sense. Surely there are enough warning signs inside and outside of the danger areas for those who can see. There is also enough solvent smell in the area for those who refuse to see the signs. Any person who refuses to be warned by the conspicuous signs and the obnoxious odors and persists in being reckless should be fired immediately. It is not a case of whether they will have an accident or not, it is merely a question of how soon it will happen. Such a man is a potential accident going somewhere to happen and if it isn't in the painting area, it will be somewhere else. The quicker he is eliminated, the better for all others concerned.

Solvent of course contributes most to the hazards. It is unfortunate too, because the solvent doesn't do a thing for us. It is a necessary evil with all painting. We buy it at a high price and then pay process money to get rid of it again. It serves only as a means of application. A great deal more thought should and must be given to higher solids applications where at least there will be less solvent involved. One statement which is quick to follow safety discussions, deals with emulsion type or water base, water-mix paints. There are some places for these types of paint but in general they have automatic application limitations to the extent that they can be even more expensive than some solvent mixed paints.

In any automatic plating process, which houses most of the paint in pipes, there is of course less danger than with the exposed open tanks or with the atomized materials. If the installation is enclosed, and the operators are outside of that enclosure when it is operating, it must be considered to be a contribution to safety.

Chosing between a five thousand gallon dip tank and a six man spray booth is no better than having to chose between chicken pox and measles. The potential hazard is there and it must be recognized and guarded against. Every known precaution can be taken, but the hazard cannot be eliminated. It can only be minimized. We must always rely on the operators to use good judgment. Just putting up No Smoking signs to let them know that these materials are inflammable is not enough. All operators are entitled to be taught how to avoid exposure and to have a real healthy respect for the potential fire or explosion.

A two-shot CO_2 system can go a long way in fire protection. But we must also remember that the sensitizing units must first get hot before the protection system can operate. The existence of a CO_2 system doesn't by any means indicate that there will be no fire even though some people go about their work as though it does.

A CO_2 sytem can at its very best keep fire losses at a minimum. That minimum too would depend greatly on which painting process was involved. By the time that a fire over a dip tank is hot enough to trigger a CO_2 system, the chances are that one shot of CO_2 will not put the fire out every time. If the fire has spread beyond the area protected by the CO_2 system, sprinklers must come into play also. When they do, then you can really begin to count the dollar loss in terms of material, equipment and production. Protection that is equally important to automatic fire protection systems is operator training. Each operator must know enough about the hazards involved to become a preventive policeman in his own right and for his own protection.

Which shall it be? A two-shot system doesn't cost twice as much as a one-shot system. Why do we install a CO_2 system in the first place? It is installed to protect the underwriters against paying too much for damages. If this is true, why don't we install a two-shot CO_2 system instead of one-shot. The second shot or reserve shot is our big protection against extra production losses from idle equipment. If CO_2 is necessary at all, then two shots are necessary.

Sure enough, our proposed painting installation engineering drawing should be submitted to the insurance underwriters for comment before installation, or even before purchase for that matter. Where should those comments be directed? They should go to the supplier who engineered the equipment but a copy should also go to the equipment buyer so that he might have an opportunity to suggest modifications in keeping with his own safety regulations and policies.

Industrial safety is a big business. This is particularly true where industrial painting processes are concerned. Any business where trophies and annual plaques are awarded is a big business. Safety drives may seem to be overdone to some people but rest assured that the statistics prove that it is cheaper to supply safety glasses and other safety devices than it is to pay for lost eyes and limbs.

The great Steinmetz was truly one of the greatest of all time. Yet, he is admired by many for one particular saying. That was, "No cigar, No Steinmetz." Very few of us are in a position to be that independent. However, we can also be sure that the great Steinmetz didn't want to carry his cigar into a hazardous area, nor did he want to endanger his own life nor that of his fellow workers. That statement was made in defiance of a "No Smoking Within the Gates" order.

Safety of equipment and safety against losses by fire causing production dollar losses isn't the only consideration either. Safety as regards health and physical injury is equally important too. There probably are no available statistics showing the relative life span of a tool maker compared to a paint sprayer. Not all people are equally healthy either. It is industry's problem and responsibility to furnish healthful working conditions for all. The mere pay grading of jobs in relation to hazard is not a total answer by any means. Responsible personnel must be selected for hazardous occupations.

Process safety should never be overlooked. We need basic well finished durable attractive products and we have a limited choice of finishing methods. If all else is equal, it would surely pay well to select a process which is the least potential fire hazard and health hazard provided of course that it can do the job at hand.

Finishing Pointers

Unconventional Chromium Plating

By J. B. Mohler

THE common chromium plating bath, in many ways, is one of the simplest baths to operate. On the other hand, in other ways it is one of the most difficult baths to operate. It is a bath of extremes. Low cathode efficiency, a narrow plating range, and very poor throwing power mark the bath with undesirable characteristics. A high tolerance for impurities and the possibility of plating at high rates are among the good points.

The properties of the deposit, namely excellent wear resistance and excellent resistance to tarnish and corrosion, place the metal in a class by itself. The fact that specifications for decorative plating repeatedly call for a thickness of 0.000010" make us realize the extreme durability of the coating. In the field of industrial chromium plating it has been confirmed many times that a hard chromium surface will increase the life of a tool steel part from 10 to 100 times. The deposit may be thin or relatively heavy, depending on the type of service.

A number of plating job shops specialize in hard chromium plating as an industrial art. These shops have developed the knowledge and skill in the use of stop-offs, robbers and odd-shaped anodes that are essential for successful chromium plating of intricate and heavy parts. Even the skilled plater will often refer such work to the chromium plating specialist. This specialist will use good equipment, adequate ventilation, proper chemical control, and many chemical and mechanical methods to prepare the surface for plating. The best is none too good for the chromium plating specialist.

Now we can look at the other side of the coin. Of all the plating baths, chromium can be the do-it-yourself bath. The bath can be operated with very little control and a minimum amount of equipment. The bath is a cleaner, pickle, and plating bath all in one. Thus, occasional chromium plating can easily be done where direct current is available or obtainable.

Chromium plating is very commonly used in some fashion in most manufacturing plants. Engineers, designers, and production men are aware of the advantages of corrosion resistance, hardness, and low coefficient of friction, all available in a hard chromium surface. A real service and a means of cutting cost can be made available to the mechanical people by setting up chromium plating facilities.

There are quite a few factors that make it possible to set up small scale chromium plating without setting up a complete conventional plating line. If plating is occasional, then conventional cleaning may be avoided. The surface should be free of rust and grease, but these can be removed mechanically. Scale and rust should be removed completely. The surface should be wet with water prior to being placed in the plating bath. Steel can be cleaned to a water-break free surface by means of scouring powder or magnesium oxide paste, by the use of a brush, water and abrasive. Good cleaning is recommended; however, the chromium plating bath itself is a very good cleaner, so that effective final cleaning takes place in the bath.

It is fortunate that anodic treatment in a chromium plating bath is the best known single means for pickling a wide variety of steels prior to chromium plating. The work is merely hung in the bath and pickled electrolytically for several minutes with anodic current.

Another fact that is fortunate is that chromic acid renders steel passive. Consequently steel tanks and racks can be used for relatively long periods of time without seriously contaminating the solution. In some cases, steel tanks are used for production chromium plating. However, for continuous plating this is not recommended and is considered unconventional.

All in all, one can chromium plate with nothing more than a current source, a steel chromium plating tank and a rinse tank. One more thing is needed — a good understanding of the limitations of chromium plating.

One fact must continuously be kept in mind for successful chromium plating. The proper curernt density must be used. If the current density is too high or too low the deposit will be worthless. More than this, the current density must be matched to the temperature. Good deposits can be produced at low current densities at low temperatures, or high current densities at high temperatures. However, the current density must be increased if the temperature is increased.

The chromium plating bath is usually warmed to take advantage of reasonably high plating rates. If heavy currents are used it will be necessary to cool the bath and a means for cooling is usually more necessary than a means for heating.

A popular chromium plating bath contains:

Chromic acid (CrO_3) — 33 oz./gal.

Sulfuric acid (H_2SO_4) — 0.33 oz./gal.

Control of the bath is simple. Simply maintain the

gravity between 20 and 22° Be by addition of CrO_3 to control chromic acid. The sulfuric acid should be maintained from 0.30 to 0.36 oz./gal. by occasional analyses. Iron will eventually contaminate the both and this must be kept in mind, since steel tanks and anodic electropickling introduce iron into the solution. If exposure to iron contamination is not overdone the bath life will be quite long. Steel anodes are only used for an emergency or a rare anode problem. Lead or lead alloy anodes should be used.

If the chromium plater has a negative code it is this: "Sharp inside corners are impossible to plate." Sharp inside corners are difficult from any bath, but this statement dramatizes the fact that the poor throwing power of a chromium plating bath must be an ever present thought. For odd shapes or parts containing recesses, special contour anodes must be built. Even for simple shapes the anodes must be evenly spaced with respect to the work.

The best first step for chromium plating is to read extensively on the subject. One cannot be unconventional with respect to cleanliness of the surface, temperature, current density, and position of anodes.

It is not possible to give exact recommendations for temperatures and current densities. Neither can one closely predict the thickness of the deposit. This is because the throwing power is so poor that the real current density differs greatly from the calculated average current density. Nevertheless a temperature, average current density, and deposition rate can be established for depositing the same part with the same part with the same racking. Once the conditions are known reproducibility is good.

The table shown may be used as a guide of approximately what to expect in terms of plating rate. The table also indicates the probable required current densities for various temperatures.

33 oz./gal. Chromic Acid Bath

Temperature °F.	*Amperes per Square Inch*	*Rate of Deposition Mils per Hour*
80	.75-1.5	.5.1.0
90	.85-1.7	.5-1.0
100	1.25-2.50	.5-1.0
110	1.50-3.00	.6-1.1
120	2.00-4.00	.9-1.6
130	2.50-5.00	1.2-1.8
140	2.75-5.50	1.5-1.8
150	3.00-6.00	1.8-2.0

METAL SPRAYING

(*Continued from page* 71)

pressed air altogether. There are two ceramic materials available at the present time, alumina base and zirconia base powder. Zirconia base coatings have the highest heat insulating value while alumina base coatings, though somewhat less effective as heat barriers, are harder and possess strength. Both of these materials, however, have very high thermal barrier properties as compared with other metals or cermets. These coatings are usually applied in thicknesses from 5 mils to 25 mils, depending upon their intended use. They have good resistance to thermal shock and are resistant to many types of abrasion at temperatures in excess of 3400°F.

There is a great deal of development work yet to be done. New systems and methods are being developed day by day.

Surface Preparation

Probably the most important single factor determining the life of a sprayed lining is the surface preparation of the basis material. When discussing sprayed metal and surface preparation there are two phases to consider. First, the degree of surface cleaning — second the degree of surface etch. The degree of cleaning cannot be compromised. It is an accepted industry standard that only an SSPC #5 white metal blast will do. White metal is defined to mean a surface with a gray white uniform metallic color slightly roughened to form a suitable anchor pattern for coating. The surface, when viewed without magnification, should be found free of visible mill scale, rust, corrosion, oxides, paint, and other foreign matter.

The depth of etch for normal resin coating should not exceed ⅓ of the total film thickness. In the case of metal spraying a heavy etch is advantageous. The bond between base and spray is strictly mechanical and a heavy etch will increase the bond characteristics. For metal spraying one of three types of abrasives is generally used.

Natural Silica Sand: This material has several disadvantages. It may lack angularity and may contain friable alkaline constituents which would break up and cling to the surface.

Crushed Chat: This material has excellent angularity. It is important to watch the source of supply. Some very high purity types will leave considerable material imbedded in the surface.

Angular Steel Grit: This material is used only where recovery is possible. It has excellent angularity and leaves nothing on the surface.

It is necessary, before concluding, to discuss a situation which comes up surprisingly frequently to plague owner, material manufacturer, and applicator alike. The situation arises where a large application is involved and no previous history exists covering a completely similar case. Both the manufacturer's tests and sample plates exposed to the particular envirnment look good but there is no history of a piece of process equipment with this particular lining in this particular service. Although manufacturers' tests and samples give excellent evidence of a particular lining's suitability, no test can exactly duplicate the owner's process and only an actual field trial can be relied on.

Science for Electroplaters

31. Cyanide Waste Treatment -- Chlorination

By L. Serota

AN effective method of eliminating cyanides in waste solution depends upon oxidation, in a basic solution, of the cyanide radical to cyanate which, upon further oxidation, produces the decomposition products carbon dioxide and nitrogen or nitrogen compounds. The use of chlorine as the commonly employed oxidizing agent for this treatment is considered one of the best methods for removing cyanides. Chlorine may be introduced as a gas or as a hypochlorite such as sodium hypochlorate, NaOCl, calcium hypochlorite or chloride of lime (bleaching powder), $CaOCl_2$.

Copper and zinc concentrations are also reduced to levels sufficiently low to permit discharge of the wastes into most streams. Copper precipitates out, depending on conditions, as black copper (cupric) oxide or blue-green copper carbonate. Where the copper precipitate is colloidal in nature, a coagulating agent will be required to precipitate the copper. Calcium or sodium hypochlorite, in the presence of calcium hydroxide, is effective in destroying the copper tartrate (Rochelle salt bath) and precipitates the copper. With silver cyanide solutions chlorination is not entirely satisfactory, since the silver redissolves and remains in solution even though the cyanide is decomposed. To recover the silver an additional precipitation step would be required.

The complexity of a cyanide bath, as a result of the ionization and interaction of the constituents, was indicated by *J. G. Dobson* for a zinc plating bath which, he noted, would contain the following: $Na_2Zn(CN)_2$, $Na_2Zn(CN)_4$, NaOH, NaCN, Na_2CO_3, Na_2ZnO_2, Na^+, Zn^{++}, $Zn(CN)_4^{--}$, ZnO_2^{--}, CN^-.

The choice of the reagents depends upon such factors as cost, convenience, sludge formation, foaming, or conditions relating to the effluent. If sufficient chlorine is added initially, this reaction can be completed in one step.

The oxidation of free cyanide in solution to cyanate upon the addition of chlorine, when the pH of the alkaline solution is above 8.5, is quantitative and immediate. It is reported complete by Dobson in less than one minute under all conditions tested. The equation generally given for this reaction is as follows: $NaCN + 2NaOH + Cl_2 \rightarrow NaCNO + 2NaCl + H_2O$.

Cyanogen Chloride

One of the earliest reports of results on cyanide removal by chlorination was that recorded by *E. F. Eldridge* in 1933, in which he refers to the quantitative formation of cyanogen chloride: $KCN + Cl_2 \rightarrow CNCl + KCl$. Tests made by Eldridge with goldfish indicated that cyanogen chloride possesses the same toxicity as the cyanide radical. *L. A. Allen* and associates report in *Journal of Hygiene* (1948) that a concentration of 2.5 mg./cu.m. of cyanogen chloride in air will result in considerable lachrymation in a man in a few minutes, and that a concentration of 400 mg./cu.m. would be lethal in a few minutes.

Dobson attributed this condition (formation of cyanogen chloride) to the fact that the experiments were performed under acid conditions. Cyanogen chloride will form in acid or neutral condition, whereas oxidation to the cyanate will occur if the solution is basic. In that respect there have been indications that proper regulation of pH in the chlorination of cyanide wastes remains uncertain. For example, *J. J. Williams*[1] found that chlorination can proceed satisfactorily with the release of cyanogen chloride and produce complete precipitation of copper when the pH of the solution is 3.0. *B. F. Dodge* interpreted this result as due to the dilute solutions treated, and the probable destruction of the cyanogen chloride remaining in the solution by the excess chlorine present or the lime added. Dobson, in his comments, noted that the solubility of cyanogen chloride is such that it does not introduce a problem when it is released from waste. However, when the pH is less than 8.5 the possibility of nitrogen trichloride, NCl_3, forming, may result. This compound is objectionable because it is decidedly irritating to the eyes and nose. To avoid the formation of this compound the suggestion advanced by Dobson was to place the alkali in the chlorine injector so that an acid condition may not occur at any point. An additional condition mentioned was the formation of chloramines at lower pH which meant an increase in the chlorine requirement and a corresponding increase in cost.

Chlorine-Alkali Requirements

The theoretical quantities of chlorine and sodium hydroxide required for the oxidation of cyanide to cyanate are 2.73 ppm. (or 2.73 pounds) chlorine and 3.08 ppm. (or 3.08 pounds) sodium hydroxide for each ppm. (or pound) of cyanide. The quantitative nature of this reaction was shown by Dobson when, by adding sufficient chlorine to a potassium cyanide solution containing 50 ppm. CN, for the theoretical conversion of 58 per cent of the cyanide to cyanate, 58 per cent of the cyanide disappeared and 49 per cent of the cyanide appeared as cyanate. The conversion of cyanide to cyanate by this method (chlorination) is an exothermic reaction; a solution containing 1000 ppm. CN will show a temperature increase of 7.16°F. If the temperature as a result of this reaction exceeds 120°F. an appreciable

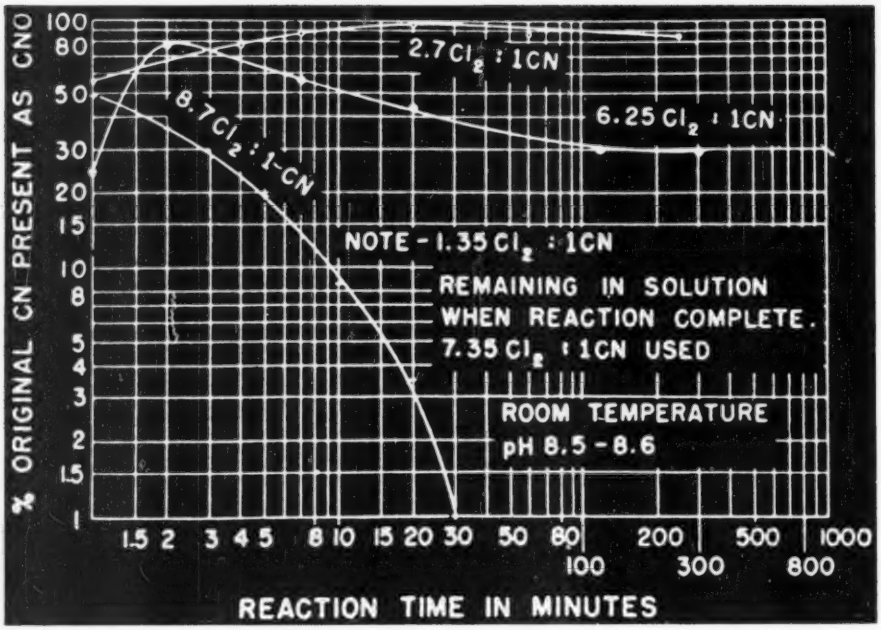


Fig. 146. Oxidation of cyanide in KCN solution containing 50 p.p.m. initial CN concentration by dosages of chlorine.

amount of the added chlorine will be used in forming chlorates, thereby reducing the percentage of chlorine available for reacting with the cyanide present. Slow addition of chlorine will permit treatment of high concentrations.

The waste which results from the first step (oxidation to cyanate) in such chlorination, when tested on living fish and on sewage sludge digestion under laboratory conditions. Dobson reports in METAL FINISHING (1947), has shown a toxicity of the cyanate equivalent to about one thousandth that of cyanide. On this basis, oxidation of cyanide to cyanate may be sufficient, unless virtually no dilution occurs or too many plants dump cyanide waste into the same water system. Where tests (ortho-tolidine-arsenite) with trade waste and laboratory samples show the presence of free available (residual) chlorine at a pH of 8.5, cyanide was absent. If other plating salts, especially chromium, are present, the ortho-tolidine-arsenite reaction is unsatisfactory. Addition of chlorine to a solution beyond the theoretical 2.73 to 1 ratio will result in oxidation of the cyanate to carbon dioxide and water. This reaction proceeds at a slower rate and requires about one hour for decomposition. The equation for this second oxidation is as follows:

$$2NaCNO + 4NaOH + 3Cl_2 \rightarrow CO_2 + 6NaCl + N_2 + 3H_2O$$

The quantities required for this second oxidation stage are 4.09 parts of chlorine and 3.08 parts of sodium hydroxide per part of cyanide (CN), or a total of 6.82 parts of chlorine and 6.16 parts sodium hydroxide per part of cyanide (CN) for complete oxidation (decomposition).

For complete oxidation of the cyanide, chlorine in excess of the theoretical amount must be added. For example, Dobson obtained the following results (Fig. 146) when chlorine was added to a solution of potassium cyanide containing 50 ppm. CN, with the pH controlled at 8.5-8.6 by a boric acid-sodium hydroxide buffer. The graph indicates that 7.35 parts of chlorine instead of the theoretical 6.82 parts per part of CN were required for complete oxidation. The excess chlorine, it is believed, was used in oxidizing nitrogen to nitrous oxide or the higher oxides of nitrogen. Dobson also refers to some cases where wastes required as much as 4 parts of chlorine per part of cyanide before a free chlorine residual could be obtained at the end of one minute. *E. J. Roy* in discussing the chlorination of cyanide waste from heat treat, copper and zinc plating systems, indicated that the amount of chlorine used varied from 3.25 pounds of chlorine to each pound of cyanide for heat treat waste to 7.58 pounds of chlorine for copper plating waste. The advantage claimed by Roy for this method is the fact that high cyanide content waste can be treated (chlorinated) and dumped into the sewer.

Industrial Application

A chlorination unit for the batch treatment of concentrated cyanide would include a treatment tank, usually placed outside the plant. The concentrated dump liquors can be emptied into the storage tank by special sewers or portable tanks. pH adjustment can be made by adding lime to the tank, or by the gradual addition of a caustic soda solution through a reagent feeder, as the thoroughly mixed waste solu-

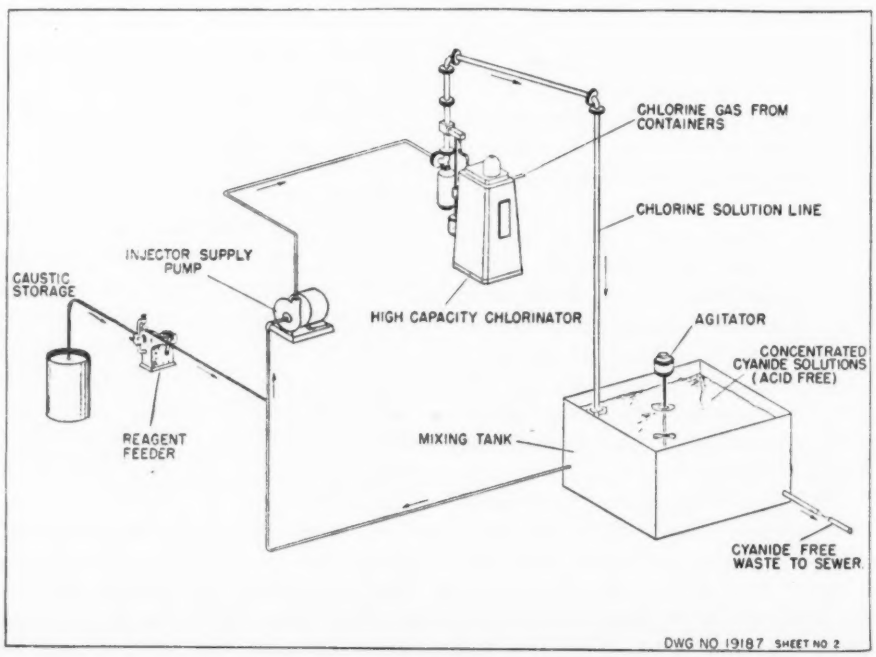


Fig. 147.

tion is pumped from the tank. This arrangement is shown as part of the chlorination schematic diagram represented in Fig. 147. The mixed waste then flows through the injector supply pump of the chlorinator unit, at which stage of the process a controlled and measured amount of chlorine is added. The treated waste is then returned to the storage tank.

When the chlorination treatment of cyanide wastes (free of acid waste) includes, in addition to the concentrated liquor, wash water (rinses) from the plant, continuous operation with automatic controls may be considered feasible. This method instead of batch process may not be economically favorable for a small plant which can store the waste of a day's operation in a storage retention tank, but could serve satisfactorily in large scale automatic operations. For example, it was reported by *C. F. Hauri* that the most effective treatment procedure for the destruction of cyanide in rinse water, following two reclaim steps from an automatic zinc plating tank in which approximately 1500 square feet of surface area per hour were plated, was continuous alkaline chlorination. The most practical procedure for a constant supply of chlorine in this automatic operation was the use of liquid chlorine. Because of limited solubility of chlorine in water, injecting the gas into the rinse water required adequate dispersing (diffusing) apparatus. Such arrangement avoided loss of chlorine, which would escape into the air if the chlorine were just bubbled through rinse water. In addition to the added cost such loss of chlorine would entail, the escape of the gas into the plant would represent a health hazard. The zinc plating tank for the treatment process contained 5-5½ oz./gal. zinc; 13-16 oz./gal. sodium cyanide, and 12-14 oz./gal. sodium hydroxide. The first of the two reclaim tanks was empty and served as a drain for plating solution as the work moved along. The second tank, which was filled with water, gradually built up a cyanide content and, at suitable intervals, this solution was returned to the plating tank. The rinse tank following the two reclaim tanks, which was found by analysis to contain 200-400 ppm. of sodium cyanide with a 15 g.p.m. water flow, was treated by chlorination.

A 100 pound per day commercial chlorinating machine, a 600 gallon per hour circulating pump and a pH meter represented the equipment selected. The rinse water was pumped from the tank through the injector of the chlorinator. The restricted flow through the orifice of the injector, causing a vacuum, served to draw the chlorine into the stream and, at the same time, produced the effect of turbulence. From the injector the stream was returned to a diffuser in the sump of the rinse tank. The electrodes of the pH meter, which included an alarm and visual indicator, were also located in the sump. Since the operation was continuous, the water in the tank was constantly recirculated, fresh or make up water was added to the rinse tank at the rate of about 1 gpm., and a like amount of chlorine rinse water containing a chlorine residue overflowed continually to the sewer. The chlorine feed averaged about 80 pounds per day. Alkalinity was adjusted by adding sodium hydroxide until the pH range was 8.5 to 10. This required about two pounds of caustic soda per hour. Free chlorine in the sump was considered sufficient evidence that cyanide was absent. The test was made by adding two drops of methyl orange to 100 ml. of a sample. The disappearance of color, upon stirring, indicated the presence of free chlorine. The pH of the solution must be 8.5-10 for the test.

This alkaline chlorination method for cyanide waste disposal, according to *N. S. Chamberlain*, is in operation in many industrial plants where the installation may be placed along the aisle opposite the rinse tanks without experiencing difficulty in safe chlorine handling practices. The recirculating process for operation of the chlorinator, with the suction end at the bottom of the first rinse tank, pumps about 10 gpm. through the chlorinator injector and returns the treated solution to the top of the tank — make-up water at a rate of about 1 gpm. is continually added and a like amount overflows to the sewer. Further, since it is possible to maintain a satisfactory chlorine residual in the rinse water at the proper pH, chlorine odors are absent. The method, Chamberlain implies, has been so effective that the amount of cyanide in the second and third rinse tank waters is not only negligible but, at times, contain a chlorine residual, so that the amount of cyanides reaching the sewer is virtually nil. The method is considered as efficient in cyanide removal as the batch method and may be compared to the "flow-through" method chlorination. In the batch method the wastes are collected in holding tanks, chlorinated under controlled conditions and then dumped to the sewer or stream, whereas in the flow-through method the wastes are chlorinated under controlled conditions while flowing past a certain point in a system of mixing, reacting, and settling tanks on the way to the sewer or stream. Some of the benefits mentioned by Chamberlain for this treatment are as follows: saving in process water for rinse purposes; no spoilage of plated surfaces by the action of chlorine in the operating range of 8.5-10. The plated surfaces in some cases, it is believed, may actually be improved by this treatment owing to the action of excess chlorine in completely eliminating all cyanides from the plated surface, thereby reducing subsequent discoloration and spotting out of stocked parts because of faulty rinsing.

Batch Method

An example of the batch method for alkaline chlorination treatment of cyanide waste from rinse water and strong cyanide discharge from plating room waste was described by *A. F. O'Connor*. The waste (700 to 800 gallons per minute) to be treated from the plating room consisted in part of 250 gpm. waste water containing an average cyanide (CN) concentration of 50 to a maximum concentration of 200 ppm. from cyanide rinse tanks reaching an average total of 400 gallons per day of concentrated cyanide waste containing 8000 ppm. of cyanide (CN).

The treatment process included oxidation of the cyanide in the dilute cyanide waste (rinse) water to the cyanate radical and a second oxidation step including complete decomposition of cyanide in the concentrated cyanide wastes to carbon dioxide and nitrogen. Installation of the system, because of the large volume, included the following functions: storage and handling of the liquid chlorine; storage of caustic soda used for pH control in the cyanide wastes during oxidation (as well as neutralization of acid wastes); dilute cyanide waste treatment system; concentrated cyanide waste treatment system.

The chlorine was received in one-ton cylinders, and plans were considered for the purchase of carload lots of fifteen one-ton cylinders, which would be stored in a cinder block shed a distance from the main building. The treatment room was in the main building but sealed from the main area to avoid chlorine diffusion in the manufacturing area in case of accidental escape of the gas. Adequate ventilating equipment was installed to meet emergencies. Chlorine from the cylinder (75 pound pressure at 70°F.) was sent through an evaporator (water bath at 150°F.) and then fed through a reducing valve where, at the reduced pressure of 10 pounds, the gas flowed through the chlorinator. A chemical control bench was installed nearby. Sodium hydroxide (50 per cent concentration), which was received in 8000 gallon tank car lots, was diluted to a 20 per cent solution to prevent freezing. (The 50% solidifies at 54°F., where the 20% caustic soda solution freezes at –180°F.)

The wastes from the various cyanide rinse locations in the plant were fed by gravity to one of two 6,000 gallon treatment tanks. The flow was adjusted so that the waste entered the tank at the bottom and flowed upward, thereby aiding in the mixing, which was done by an agitator. An opening at the top of the tank enabled the waste to flow into the second tank, where additional agitation was provided, before discharging to the sewer. Oxidation of the cyanide, at a pH of 8.5, to the cyanate occurred almost immediately. Chlorine was added by pumping about 70 gallons per minute of waste from the first tank through the chlorinator and back to the first tank. The pH was maintained by the addition of caustic soda. Control of the chlorination rate was based upon the amount of free chlorine in the first treatment tank. This control check as well as the pH reading was made every fifteen minutes. An excess of 1.5 pounds of chlorine above the theoretical amount (2.6 pounds) was usually considered desirable.

The second tank was primarily a holding tank, thereby increasing the time that the waste was in contact with chlorine before entering the sewer. If chlorination proceeds properly most of the excess chlorine should be consumed in the oxidation of part of the cyanate to carbon dioxide and nitrogen before discharging to the sewer.

A 2000 gallon holding tank was used for storing the concentrated cyanide waste which was collected by a second drainage system. Treatment took place in a 750 gallon tank into which about 350 gallons of the stored cyanide waste was run. Chlorination then proceeded (not above 120°F.). After a check was made on the cyanide and caustic soda present, a pH of 8.5 or above for the solution was maintained by the flow of caustic soda solution. When an excess of chlorine was shown to be present, the system was shut down and allowed to stand for an hour. If, at the end of this period, tests indicated that the chlorine residual was above one part per million, the solution was run to the sewer. Chlorination was continued if the excess of chlorine was less than that indicated.

Batch Modifications

Removal of cyanide waste by oxidation to cyanate with chlorine at a pH of 9.0 was described in *Plating* (1951). The installation was equipped to handle 1500 pounds of cyanide per day. Plating metals in the cyanate waste were precipitated and removed in a sludge settling unit then pumped to a lagoon. The effluent from the treatment was discharged into the river.

The alkaline cyanide waste was received in a sump, then pumped to an equalizing basin. From this unit the cyanide waste was pumped through the chlorinator injector, with the flow of the solution continuing to the cyanide (treatment) tank. Concentrated caustic soda solution was introduced into the pump suction line before the chlorinator. Immersion electrodes in the inlet chamber of the cyanide treatment tank served to regulate the caustic soda addition by means of a proportioning valve, thereby maintaining a pH of 9.0. Control of the chlorine addition was based upon the oxidation reduction potentials between the untreated and the oxidized cyanide waste.

Similarly, *J. E. Cooper* reported in 1951, that the new plating-waste-treatment plant of the Ford Motor Co. at Monroe, Mich. which, he contended, would be the largest installation to date, would use the semi-batch alkaline-chlorination method for the cyanide treatment of spent concentrated baths and rinse waters. This method was preferred because of the difficulty and increased cost experienced in removing salts from cyanide solutions by acidification and aeration. The cyanide wastes collected in three 20,000 gallon holding and mixing tanks were treated with chlorine and lime.

Heavy metals present as complex cyanide wastes are precipitated as sludge during alkaline-chlorination. These metals, the Orsanco booklet "*Metal-Finishing Wastes*" notes, are more resistant to chlorination. In such instances, chlorination must be continued until the absence of cyanides is shown by standard test methods, when the pH is reduced to a value below 7, by the addition of acid or continued chlorination. Hydrochloric acid is, seemingly, more effective than sulfuric acid in the decomposition of these cyanide complexes. An excessive amount of free chlorine remaining in solution can be removed by adding sodium bisulfite or sodium thiosulfate.

Chlorination, the same reference notes, will not destroy the soluble copper tartrate complex present in the Rochelle salt copper cyanide baths. Since the copper compounds may be toxic to stream life, the use of calcium or sodium hypochlorite in the presence of calcium chloride or calcium hydroxide is suggested for the decomposition of the tartrate complex and the precipitation of copper. *L. E. Lancy* indicated that, with a high chlorine excess, 20-50 ppm., most of the cuprous ion in the copper complex in copper cyanide solutions is rapidly oxidized to black cupric oxide with some of the copper precipitating as the cuprous salt. The rapid settling of the cupric oxide reduces the chance for dragout of copper salts. The treatment solution, Lancy suggested, should be allowed to rest for at least eight hours to assure complete conversion of the cyanates. After a quantitative determination, the free chlorine and the pH may be reduced and the sludge settled over a week-end.

On the basis of results gained from an economic study of the chlorination process for cyanide waste disposal, *B. F. Dodge* concluded that gaseous chlorine is the cheapest source of available chlorine for large plants. The use of 15 per cent sodium hypochlorite or of calcium hypochlorite is ruled out by Dodge where the concentration is even as low as 10 ppm. The use of lime instead of sodium hydroxide for pH control in chlorine treatment is recommended for concentrations higher than 200 ppm. of cyanide.

SHOP PROBLEMS

BARREL FINISHING — POLISHING AND BUFFING
CLEANING — ANODIZING — ELECTROPLATING
RUSTPROOFING — LACQUERING AND ENAMELING

METAL FINISHING publishes, each month, a portion of the inquiries answered as a service to subscribers. If any reader disagrees with the answers or knows of better or more information on the problem discussed, the information will be gratefully received and the sender's name will be kept confidential, if desired.

Induction Heating vs. Electrostatic Heating

Question: Is there any difference between high frequency induction and electrostatic high frequency heating for baking or force drying painted parts?

D. M.

Answer: The term *frequency induction* is usually applied to those frequencies below 1,000 kilocycles; they are used to heat items that have metal as their major basis material. Frequencies over 1,000 Kilocycles, often called *electrostatic* high frequencies, will heat non-metals as well as metals. This latter type, "dielectric heating," has not found widespread usage as yet.

High Temperature Coatings

Question: We are interested in obtaining information and operating data regarding a process called "Siliconizing". We understand this process is used to apply a hard and non-corrosive surface to a part without changing any dimensions of the part.

We would also like to know the names of the suppliers of chrome powders used in chrome diffusion coating processes.

H. B.

Answer: Siliconizing is the term employed for the deposition of a film of silicon and diffusion into the basis metal at high temperature. The film can be applied by heating at about 950 deg. C. in contact with ferrosilicon powder and other chemicals, or by gas plating. For information on the latter, you can communicate with The Commonwealth Engineering Co. of Ohio, 1771 Springfield St., Dayton 3, Ohio.

A supplier of chromium powders used in the chromium diffusion process is Chromalloy Corp., 450 Tarrytown Road, White Plains, N. Y.

"Ormulu" Finish

Question: Would you kindly tell us how to produce an "ormulu" gold finish, through a 24 kt gold plating set-up.

A. F. H.

Answer: A cheap ormolu finish can be produced by applying a heavy copper deposit from a cold cyanide bath, which will result in a dead finish. This is then highlighted, brass plated and finally gold plated. A variation can also be produced by copper plating from a regular copper solution and bright dipping, followed by highlighting, and gold plating. If the part has not been soft soldered but is solid brass, the copper plating can be eliminated.

The original finish was produced by heavily gold plating, then covering with a paste of:

Potash alum	50 parts
Red ochre	17 "
Zinc sulfate	10 "
Sodium chloride	3 "
Potassium nitrate	20 "

Water—to make thin paste

The coated parts were then heated until they began to blacken, after which they were quenched in cold water, rinsed and brushed with a dilute solution of acetic or nitric acid.

Oxidizing and Barrel Highlighting

Question: I have enjoyed reading your publication for many years and have observed how you have helped others, therefore I am hopeful that you will be able to help me.

My problem is oxidizing and highlight polishing of costume jewelry (sample enclosed). I am hopeful of oxidizing and then polishing by tumbling, if this is practical. Could you recommend the best oxidizing agent and the proper tumbling procedures and tumbling medium to use for polishing silver?

H. K.

Answer: Silver can be oxidized by use of liver of sulfur solutions containing ammonia, by polysulfide solutions sold by most plating supply houses under the name "oxidizing liquid", and by solutions of tellurium chloride. In this particular case, the polysulfide solutions are suggested as most convenient to use and most economical.

The sample forwarded can be relieved and highlighted by first tumbling with an abrasive medium, followed by ball burnishing after careful rinsing to remove all traces of abrasive. On page 584 of the 1957 edition of the METAL FINISHING GUIDEBOOK will be found a list of suppliers of media and compounds for the purpose.

Spotting-Out

Question: In the March issue of METAL FINISHING we found an interesting article on "spotting out". We are having a similar problem with our copper plated caskets and the trouble usually occurs this time of the year.

After plating, the caskets develop heavy black and bluish black stains which we believe to be oxides or sulphides. The next step in the processing is to put them through a spray cleaning machine, after which they are immediately dried in convection oven at about 180 degrees; are then coated with a mist coat of phenolic resin (lacquer type); and then after about two minutes flash-off are painted with lacquer base primer.

We notice that you recommend baking at about 225 degrees prior to lacquering to cure "spotting out" on oxidized copper finishes and we are

wondering whether we could cure our oxide and sulphide problem by raising our convection oven temperature up to 225 degrees or more, or if you can suggest some other processing that will get us out of our troubles.

W. E. S.

Answer: It would be advisable to raise the temperature in the convection oven at 225 degree F. to eliminate moisture from the surface.

In addition, it is suggested that, just before lacquering, the parts should be wiped off carefully, since small particles of sulfide from the oxidizing or relieving operations remaining on the surface under the lacquer will result in what is known as a "spotting-in" or "crystal" spotting effect.

Coating Metal to Protect it From Corrosion

Question: We have a part which must be exposed outdoors. We would like your opinion as to which coating system would be more corrosion protective, system A: baked enamel over an iron oxide primer on phosphated steel, or system B: the same baked enamel over a phosphated zinc plated steel?

H. B. W.

Answer: It is not possible to give a direct answer to a question of this type. Factors which must be considered are 1) how and where the parts will be used, 2) the thicknesses of the coatings involved, and 3) the quality of each coating applied. Although one system may serve satisfactorily for one set of environmental conditions, it may be totally unsuitable for another.

We suggest you run a series of tests to determine the most practical coating system. Establish a coating thickness for the top coat, vary the thicknesses for underlying coatings, then subject the test samples to environments which simulate intended service conditions. Even though an exact quantitative evaluation may prove to be difficult, if not impossible, to obtain by this method, you should be able to at least gain a rough indication of the relative merits of each system.

Etching Stainless Steel

Question: We are interested in obtaining a sand blasted effect on a stainless steel part. At present we are dipping in three parts hydrochloric acid and one part nitric acid. We have not found anything else that will touch it and give us the dull finish required. Our only objection to this is the amount of acid we use. The solution breaks down rapidly. Do you have any suggestions?

H. J. T.

Answer: The same etched effect can be produced by immersion in a solution of equal parts muriatic acid and 40 or 42 degree Baume ferric chloride solution. The latter can be prepared by dissolving solid ferric chloride in water, if the solution is not available locally.

Anodize Strip Tank

Question: I am running into difficulty on my anodizing strip tank. Everything connected with it is made of stainless steel. In the past two years I have replaced the drain-out valve four times. The solution corrodes the metal and springs a leak. This happens on the tank side of the valve which contains the hot solution.

The solution is 2.8 oz./gal. chromic acid and 5.6 fl.oz./gal. phosphoric acid heated to a temperature of 180°F.

A. F.

Answer: Welded stainless steel joints are very susceptible to intergranular corrosion and require annealing after welding unless stabilized Type 321 and 347 stainless steels are used, or very low carbon type.

It might be more convenient, in this case, to plug the drain opening and use a siphon for emptying.

Hard Anodizing

Question: We are very interested in hard anodizing and in the Hardas process in particular. Could you furnish us with the address of the people in England who have this process?

We would also appreciate any information you might have available on either the Hardas process or hard anodizing in general.

D. G. M.

Answer: The "Hardas" process is offered by Hard Aluminum Surfaces Ltd., 38 Mair St., Glasgow, S. W. 1. Scotland, and employs alternating current superimposed on the direct current in an oxalic acid solution at low temperature. The process was described by W. Campbell (J. Electrodep. Tech. Soc., *28*, 273. 1952).

American hard anodizing procedures will be found in the METAL FINISHING GUIDEBOOK.

Rough and Pitted Silver Deposits

Question: I am using the silver solution composed of the following:

Silver cyanide	4.0	oz./gal.
Sodium cyanide	6.4	"
Sodium carbonate	6.0	"

Operating Conditions:

Metallic silver	3.0 tr oz./gal.
Free cyanide	4.0 oz./gal.

My problem is this: at any current density from 1-15 A/SF the plate is rough and pitted. We tried continuous filtration and rotation of cathode. We also made a new solution of the same composition with the same results. Can silver be dummied? If so, how many amps./sq. ft. should it be dummied at?

P. H.

Answer: We would not suggest dummying to purify a silver solution, since it is quite expensive and rarely effective. You can try increasing the free cyanide content to 5 oz./gal. and also carbon treat the solution with 4 lbs. activated carbon per hundred gallons to remove possible organic impurities, which would result in pitting.

Smoother deposits will also be obtained by use of a silver brightener such as carbon disulfide or ammonium thiosulfate. Details will be found in any recent edition of the METAL FINISHING GUIDEBOOK in the section on silver plating. Proprietary brighteners are also available.

Scale Removal

Question: At the present time we have started working some hot roll bars and rods up to ½"-⅝" diameter and are having difficulty cleaning or pickling these prior to zinc plate or prior to adding a phosphate type surface.

We have used muriatic acid, have bought some of the commercial items and found both to be unsatisfactory. We would appreciate it if you could give us any information at your earliest convenience as to the best possible method of pickling hot roll items such as this. These items are used in the construction of wrought iron furniture.

One other problem which is not a new one but one in which we are continually working, and we thought you might be able to give us a little additional information, is pickling and

cleaning bright basic wire prior to bright nickel plating. This wire we use on oven racks, refrigerator shelves, displays, etc.

C. B. R.

Answer: The most economical method of removing heavy scale from hot-rolled steel is a 5-10% by volume solution of sulfuric acid containing a suitable pickling inhibitor and operated at about 150 deg. F.

In fabricating wire products, the material should be ordered as extra-clean, extra-bright basic finish for best results and the tips of the spot welders should be maintained properly to avoid a heavy burn at the weld areas. With attention paid to these two conditions, anodic alkaline cleaning, followed by a dip for a few seconds in muriatic acid, 25-50% by volume, will generally be sufficient. However, many firms finishing wire goods have found that inclusion of an alkaline derusting bath in the cycle, with periodic reverse current, is very desirable.

Gold Recovery from Old Baths

Question: We have on hand at the present time, several hundred gallons of contamined gold solution which we feel is of some value to us. Will you please give us an outline to follow by which we may reduce all this liquid and recover the gold?

L. P.

Answer: Most refiners can supply carboys for shipping gold solutions to their plants. However, if you wish to save shipping costs, you can add 1 oz./gal. zinc dust to the solution and stir occasionally. After settling overnight, the supernatant solution is drawn off and discarded. The mud will contain all the gold and, after washing with water two or three times, may be sent to the refiner.

The gold can also be recovered in metallic form by plating out from the hot solution on sheets of stainless steel, using stainless steel anodes. However, the deposit will be impure and will require refining before reuse.

Streaks and Spots on Brass

Question: We are doing brass on zinc die castings which have some porosity. We use copper, nickel and brass. After brass plating we find dark streaks from the porosity, and have trouble with brown spots under the lacquer.

Any information you could give us to prevent this breaking out would be appreciated.

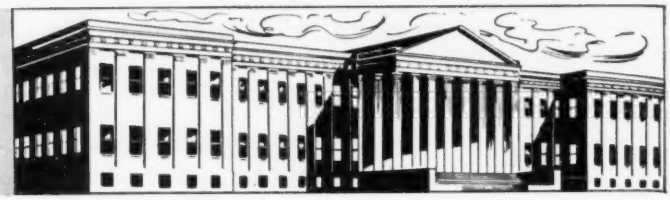
R. L. P.

Answer: Dark streaks are usually due to insufficient copper deposit, which results in deposition of nickel by immersion, or to zinc contamination in the nickel bath. The first condition is eliminated by applying a heavier copper deposit and the second by dummying the nickel solution at 3 to 5 amperes per square foot, preferably employing corrugated sheet cathodes.

Brown spots are due to spotting-out. Although we know of no method of eliminating it completely, the condition can be minimized by the use of rinse-aids in the final rinse water, a mild acid dip, and by baking the plated parts for 15 minutes at about 225 deg. F. The articles should be lacquered immediately after baking, as soon as they have cooled down sufficiently.

Patents

RECENTLY GRANTED PATENTS IN THE METAL FINISHING FIELD



Electrostatic Spraying

U. S. Patent 2,794,417. *June* 4, 1957. *W. A. Starkey and E. M. Ransburg, assignors to Ransburg Electro-Coating Corp.*

In apparatus for electrostatically applying liquid coating material to an article, an atomizing head positioned adjacent the article to be coated, said head comprising a group of elongated members and means for encasing said members and intimately compacting them together, said members projecting for a portion of their length beyond said encasing means, means for maintaining between said projecting member portions and the article an electrostatic field of sufficient strength both to electrostatically atomize fine particles from coating material on the surfaces of said projecting portions and to electrostatically deposit on the article the particles so atomized, and means for supplying liquid coating material to said members from their encased ends to the surfaces of said projecting portions at a rate no greater than that at which it is electrostatically atomized.

Corrosion Preventive

U. S. Patent 2,794,782. *June* 4, 1957. *E. P. Cunningham and D. W. Dinsmore, assignors to Monsanto Chemical Co.*

An anti-rust mineral oil fraction containing dissolved therein the reaction product obtained by reacting an aliphatic monocarboxylic acid with a polyalkylenepolyamine and reacting an alkenyl succinic acid anhydride with said intermediate product, the said reaction product dissolved in the said mineral oil fraction providing a solution characterized by being normally susceptible to the formation of oil-in-water emulsions in the presence of water, and (*b*) between about 0.001% and about 15% by weight based on the mineral oil of a dimeric acid produced by the condensation of unsaturated aliphatic monocarboxylic acids.

Etching Aluminum

U. S. Patent 2,795,490. *June* 11, 1957. *K. W. Newman, D. C. Atkins, Jr., and G. S. Douglas, assignors to Turco Products, Inc.*

A method of etching an article having an aluminum alloy surface to produce a smooth substantially nodule-free etched surface, which comprises treating said alloy surface with an alkali etching solution having dissolved therein a sulfur-containing material of the class consisting of those having a reactive sulfur and those having a reactive SH—group, said sulfur-containing material being capable of forming a precipitate with an ion taken from the group consisting of copper, zinc and iron ions when a solution containing such ion is added to an alkali solution of said sulfur-containing material.

Etching Aluminum

U. S. Patent 2,795,491. *June* 11, 1957. *K. W. Newman, D. C. Atkins, Jr., and G. S. Douglas, assignors to Turco Products, Inc.*

A method of etching an article having an aluminum alloy surface to produce a smooth substantially nodule-free etched surface, which comprises treating said alloy surface with an alkali etching solution having dissolved therein a material of the group consisting of an alkali metal sulfide, an alkali metal polysulfide, and sulfur.

Porcelain Enamel Frit

U. S. Patent 2,795,506. *June* 11, 1957. *B. J. Sweo and J. F. Uher, assignors to Ferro Corp.*

The method of producing a porcelain enamel frit which comprises admixing porcelain enamel raw batch ingredients, smelting said admixture in a smelter until molten, fritting said molten material, reducing the particle size of said fritted material until it will pass 100% through a 60 mesh sieve and then heating said material at from about 850°F. to no more than 100°F. over the interferometer softening point of said porcelain enamel for at least one-half hour.

Plating Process

U. S. Patent 2,795,032. *June* 11, 1957. *D. R. Kerstetter, assignor to Sylvania Electric Products, Inc.*

In the method of making grids, the steps of applying to a surface of an apertured metallic strip a layer of material having grid-work conductive design portions exposed through the apertures in the strip, and plating the so exposed portions to build up the level of the design to a desired thickness in the strip and to bond the plating to the strip.

Phosphate Conversion Coating

U. S. Patent, 2,795,518. *June* 11, 1957. *J. A. Carroll and N. J. Newhard, assignors to American Chemical Paint Co.*

In the art of increasing the corrosion resistance of metal surfaces from the class consisting of steel, zinc and aluminum, the process which consists in subjecting the surface to the action of a phosphating solution which is capable of producing a chemically bonded crystalline phosphate coating on at least one of the metals from the class which consists of steel and zinc, water rinsing the surface so treated, and then subjecting the rinsed surface to the action of an acidulated solution of chromic acid and a fluorine bearing compound, the fluorine bearing compound being chosen from the class of complex fluorides which consists of fluosilicic acid, fluoboric acid, fluozirconic acid, fluostannic acid, fluotitanic acid and the soluble salts of any of them, the chromic acid concentration lying between 0.30 and 10 grams per liter, the fluorine content between 0.10 and 10 grams per liter with the proportions of both being so chosen as to yield a solution the pH of which lie between 1.3 and 4.0.

Bright Nickel Bath

U. S. Patent 2,795,540. *June* 11, 1957. *H. Brown, assignor to The Udylite Research Corp.*

A bath for electrodepositing lustrous

nickel comprising an aqueous acidic solution consisting essentially of an electrolyte selected from the group consisting of nickel sulfate, nickel chloride and mixtures thereof in the presence of an alkoxy coumarin having not more than 2 carbon atoms in the alkoxy group, said alkoxy group being in a position on the coumarin nucleus numbered at least as high as 5, said alkoxy coumarin being present in the amount of about 0.05 gram/liter to saturation.

Machine for Producing Buffing Wheel Sections

U. S. Patent 2,795,789. *June* 18, 1957. *G. R. Churchill, assignor to George R. Churchill Co., Inc.*

In a machine of the character described, in combination, stapling mechanism, means for supporting a circular disk with its marginal edge in operative relation to said stapling mechanism, means for intermittently advancing an elongated strip of buffing material, means for severing the strip to form successive individual buffing elements, means for supporting and transferring said individual elements to dispose one end thereof in overlapping and radially extended relation to said disk, means for operating said stapling mechanism to secure the element to the disk, and means for indexing said disk to present an adjacent portion of the disk in position to receive a succeeding buffing element.

Etching Aluminum

U. S. Patent 2,796,334. *June* 18, 1957. *D. L. Robinson, assignor to Aluminum Co. of America*

A process for treating aluminum to increase its effective surface area, which comprises chemically etching the aluminum by immersion for about ¾ to 2 minutes in a solution maintained at about 70 to 100°C. and consisting essentially of about 0.5 to 2 percent by weight hydrochloric acid, about 1 to 10 percent sodium chloride, about 0.06 to 0.2 percent dissolved bivalent copper, and water.

Aluminum Etching

U. S. Patent 2,796,335. *June* 18, 1957. *D. L. Robinson, assignor to Aluminum Co. of America*

A process for treating aluminum, to increase its effective surface area, which comprises chemically etching the aluminum by immersion for about ¾ to 2 minutes in a solution maintained at about 70 to 100°C. and consisting essentially of about 0.2 to 0.6 per cent by weight dissolved nitrate (NO_3^-), about 1 to 10 per cent sodium chloride, about 0.2 to 0.6 per cent dissolved bivalent copper (Cu^{++}), and water.

Corrosion Inhibiting and Fingerprint Removing Composition

U. S. Patent 2,796,353. *June* 18, 1957. *E. A. Dieman and A. E. Brehm, assignors to Standard Oil Co.*

A composition of matter consisting essentially of from about 3% to about 15% of a preferentially oil-soluble alkaline earth sulfonate, from about 40% to about 60% of a hydrocarbon solvent boiling in the range of from about 100°F. to about 650°F., from about 1% to about 15% of a water-soluble oxygenated organic solvent selected from the class consisting of an aliphatic alcohol and an aliphatic ketone, from about 0.5% to about 7% of a preferentially water-soluble sulfonate from about 0.1% to about 5% of a monobasic carbocylic acid selected from the class consisting of benzoic acid, cinnamic acid and napthene hydroxamic acid, from about 1% to about 10% water, and from about 5% to about 20% of a hydrocarbon oil.

Conversion Coating

U. S. Patent 2,796,361. *June* 18, 1957. *A. E. Chester, B. R. Jeremias and J. T. Irwin, assignors to Poor & Co.*

A process of improving corrosion resistance which comprises treating a zinc-copper alloy surfaced article overplated with chromium with an aqueous solution of chromic acid and hydrochloric acid having a pH within the range of 0.75 to 1.75 said alloy of zinc and copper containing 5% to 30% by weight copper, the remainder being zinc.

Abrasive Blasting Grit

U. S. Patent 2,796,338. *June* 18, 1957. *R. Haberl, assignor to Firma Bayrische Berg-, Hutten- and Salzwerke Akt.-Ges.*

Blasting materials essentially consisting of a mixture of substantially spherical smooth surfaced metal grains composed of approximately 95.62% iron, 0.8% silicon, 0.6% managanese, 0.8% phosphorus, 0.08% sulfur and 2.1% carbon and rough surfaced broken metal grains composed of approximately 95.12% iron, 1.2% silicon, 0.4% managanese, 0.1% phosphorus, 0.08% sulfur, 2.1% carbon, 0.5% nickel and 0.5% chromium, said smooth surfaced metal grains being present in an amount of 20-50% by weight and said rough surfaced broken metal grains constituting the remainder.

Fused Caustic Descaling

U. S. Patent 2,796,366. *June* 18, 1957. *G. F. Carter, assignor to E. I. du Pont de Nemours and Co.*

The process for removing oxide scale from the surface of an article formed from a metal substantially non-reactive with alkali metal hydroxides which comprises contacting said article at a temperature below the melting point thereof with a molten composition comprising a molten alkali metal hydroxide to which has been supplied about 0.3—10% by weight, based on weight of the total composition, of the oxide of an alkali metal, about 0.3—20% by weight of an alkali metal hydride, and about 0.2—10% by weight of iron dissolved as one of its oxidic compounds and subsequently removing the resulting reduced scale therefrom.

Conversion Coating

U. S. Patent 2,796,369. *June* 18, 1957. *A. E. Chester, B. R. Jeremias and J. T. Irwin, assignors to Poor & Co.*

A process of improving corrosion resistance which comprises treating a zinc-copper alloy surfaced article wherein the alloy contains 5% to 30% by weight copper, the remainder being zinc, with an aqueous solution consisting essentially of chromic acid and nitric acid having a pH within the range of 0.75 to 1.75 and containing 1 to 10 grams of chromium per liter of solution.

Conversion Coating

U. S. Patent 2,796,370. *June* 18. 1957. *C. W. Ostrander and N. R. Congiundi, assignors to Charles W. Ostrander.*

A composition for use in the art of applying a chemically bonded coating on metal surfaces, said composition consisting essentially of hexavalent chromium, a fluorine-bearing compound and a soluble cyanide selected from the group consisting of ferricyanide and ferrocyanide in proportions which are capable of coating aluminum.

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LITHO IN U.S.A.

Coating Composition

U. S. Patent 2,797,202. *June* 25, 1957. *A. S. Pitre and J. R. Saroyan*

An anti-corrosive composition consisting essentially of 314 parts of a resin, 314 parts coal tar naphtha, 37 parts coal tar, 103 parts of a plasticizer selected from the group consisting of manganese linoleate, lead linoleate, linseed oil fatty acids and lead oleate, 184 parts zinc oxide, 92 parts chrome yellow, and 92 parts silica, said resin being produced by blending 108 parts of a polymer with 360 parts of rosin, the temperature of the polymer having been elevated to from 275°F. to 325°F. to partially polymerize and dehydrate the same, the temperature of said polymer never exceeding 325°F. during the entire process, said polymer being formed by reacting, to the point at which the formaldehyde odor disappears, an aqueous mixture containing phenol and formaldehyde, the mol ratio of phenol to formaldehyde being 1¼:1 and lead acetate as catalyst and buffer in the amount of about 0.04 mol for each mol of formaldehyde.

Paint Removing Tools

U. S. Patent 2,797,294. *June* 25, 1957. *P. C. Cox, assignor to The Osborn Mfg. Co., Ltd.*

An electric paint-removing tool comprising a flat plate, an electric heating element assembled to one face of the said plate, at least one layer of heat resisting and insulating material assembled to the opposite face of the plate, a cover surmounting and secured relatively to the said material in spaced relationship to the plate, an operating handle provided with a number of bosses which project from one end thereof and are assembled to the cover to retain the said end in spaced relationship to the said cover, and a scraping blade provided on one edge of the plate outwardly of the heating element, the said blade projecting through the plane of the element to locate an operative scraping edge thereof beyond the opposite side of the element to the cover.

Paint Roller

U. S. Patent 2,797,427. *July* 2, 1957. *S. D. Tate*

A ceiling side wall juncture painter comprising a handle member having a hand grip on the portion adjacent one end, there being a bore extending inwardly from the other end of said handle member, a support rod slidable in said handle member bore and having one end exteriorly of the other end of said handle member, a shaft positioned transversely of and on one side of said support rod and attached at one end to said one end of said support rod, a guide wheel carried by said shaft for rotation about said shaft as an axis, another shaft arranged on the other side of and in longitudinal spaced relation with respect to said support rod and carried by said handle member, a roller carried by said another shaft for rotation about the last mentioned shaft as an axis, and a covering of projecting fibers on the periphery of said roller.

Conversion Coating

U. S. Patent 2,796,371. *June* 18, 1957. *C. W. Ostrander, N. R. Congiundi and W. E. Pocock, assignors to Allied Research Products, Inc.*

A composition for use in aqueous solution to impart a corrosion-resistant coating to aluminum and alloys thereof in which the coating-producing ingredients consist essentially of hexavalent chromium, a fluorine-bearing compound, and a cyanide selected from the group consisting of ferricyanic acid, ferrocyanic acid, and salts thereof and mixtures of these acids and salts, and a water soluble source of barium.

ABSTRACTS

Surface Preparation by Wet Sand Blasting—Application to Hard Chromium Plating

M. J. Icxl: Paper read at the Annual Hard Chromium Conference, Paris (1955).

After a survey of sand blasting processes, the author discusses the principle of wet sand blasting, with the influence of the mass of the abrasive particles and their speed of projection from the fluid. Wet sand blasting consists in the projection of abrasive grains, of a careful selected size of 1 to 150 microns, at a great speed, by means of compressed air, the wet particles striking the piece in a water medium. The result is that the thermal effect is reduced and, if oxidation reactions are produced, they are in an aqueous medium. The author gives details of the features of the apparatus and of the mode of operation. The advantage of the process is that complete cleaning is obtained. The treated surface presents a state of physico-chemico cleaning which is almost perfect.

The author cites several applications of this process for plating, notably the copper plating of molybdenum, and discusses by means of photomicrographs the results actually obtained with wet sand blasting as regards thick electroplated coatings of chromium and of nickel.

Defects with Brass Plating; Causes and Avoidance

E. R. Thews: *Metallwarenindustrie und Galvanotechnik*. Vol. 47, No. 7, 295.

In brass plating as with all alloy plating baths, the bath composition and its maintenance at a constant value is of paramount importance. The total metal content of the bath will vary within relatively narrow limits. Too high a total metal content of the bath will result in brass coatings unstable to air, excessive gas formation, and dull, rough deposits. Too low a total metal content will give less metal deposition and poor throwing power.

The most favorable concentration range for the cyanide concentration of the bath is narrower than is generally accepted. A low free cyanide content will give non-uniform dull brass deposits, anode disturbances, transposition of the alloy deposition relationships of the brass and low corrosion resistance. On the other hand, too high a cyanide content will reduce the copper content of the brass plate (the copper becomes increasingly less noble than zinc). It leads also to excessive gassing, reduced throwing power and reduced plating efficiency.

Caustic soda, sodium carbonate, Rochelle salt, etc., assume in part the function of the free cyanide and, thus, make possible a reduction of the cyanide content. Sodium bisulfite serves as a clarification agent in the electrolyte and increases the uniformity and brilliance of the brass plate. It must be neutralized with caustic soda before the addition to avoid decomposition of the cyanide. Ammonia similarly serves for clarification of the electrolyte, improves the conductivity of the bath, acts favorably on the composition and uniformity of the brass and reduces the unfavorable effect of too high a cyanide content. Production of matt deposits is prevented. Excess of ammonia, as also of caustic soda, reduces the copper content of the brass.

Careful attention needs also to be paid to the anodes. Either brass or copper anodes can be used but, with the former, it is difficult to avoid anode incrustation which necessitates careful cleaning. The best composition to use is 80% copper and 20% zinc. It is better to use copper anodes, as the zinc content of the bath can be fairly easily maintained. Mechanical cleaning of the anodes then becomes unnecessary. Even if brass anodes are used in the bath, a certain number of copper anodes should be used as well. The shape of the anodes also is of great influence on the brass deposition. Flat anodes are unfavorable in particular because the side of the anode facing the bath wall is almost always inactive. Better results are obtained with round anodes and, best of all, with elliptical-shaped anodes.

The deposited brass is not merely a mixed metal but a true alloy of definite composition. The color of the plate obtained will depend upon the relative metal contents. A copper-zinc ratio of 90-10 will give bronze-colored deposits; 80-20 a green brass color; 70-30 a full yellow brass color; and 60-40, a white brass tone.

The bath voltage and current density conditions need careful control. The voltage will be 2-3; too low a voltage will lead to red coloration and to non-uniform deposits and defective throwing power, while too high a voltage will lead to dark and rough deposits as well as possible blistering. Too high a current density will give coarse crystalline, nodular deposits and poor current efficiencies. The color and physical characteristics of the deposit are strongly influenced by the pH value of the electrolyte. Good uniform deposits are obtained with a pH value of 12.2 in a warm electrolyte but this value should not be exceeded. Sometimes with this pH value there will result spotty, non-uniform deposits. In such cases, the pH should be reduced to about 10. If this type of defect still persists then it is not due to the pH but the trouble must be looked for elsewhere.

Chemical Polishing of Stainless Steel

A. V. Krusenstjern: *Metalloberflaeche*. No. 10, p. B148.

The conditions which allow of obtaining by means of chemical polishing a maximum brilliancy with parts of austenitic chrome-nickel steels have not yet been absolutely entirely elucidiated. The present investigation had the objective of determining the influence which could be exerted on the polish by one or several forming operations on austenitic stainless steel prior to polishing, the forming being either hot or cold, with or without surface treatments.

The parts to be tested were brought to the same characteristics by appropriate chemical treatments. They were polished by being immersed at 85°C. for 10 minutes in a bath of phosphoric, hydrochloric, and nitric acids, regulated by an inhibitor. The surface brilliance was measured by means of an indicator with partial absorption on a prism.

The results indicate that the surface brilliance diminishes according to the degree of drawn depth or the elongation of the piece, the inter-crystalline glide lines which appear, progressively, having an unfavorable effect. The coarseness of the grain, (which can be increased by successive reheatings)

is on the contrary, a factor of improvement.

Finishing of Springs

Galvano (Paris). Vol. 24, No. 226, p. 29.

For steel springs, finishing serves the following objects: protection against corrosion, improvement of the dynamic resistance, coatings destined to facilitate joining, coatings destined to confer certain desired electrical properties to the spring and, finally, improvement of the appearance. For preparing steel springs for electroplating, after heat treatment, the springs are descaled unless a bright anneal in a neutral atmosphere has been given. When there has been no heat treatment, simple degreasing is sufficient. Descaling is generally conducted in an acid bath and hydrogen embrittlement must be guarded against. Where the scale is thin and the springs are of small size, descaling can be conducted by drum finishing, the sand being fortified with 6.2-12.4 g./l. sodium cyanide solution. Roughening of the wire surface must be avoided.

The usual plated coatings are nickel, tin, zinc, and cadmium. For electrical applications, there are employed silver, gold and rhodium. Cadmium coating is the most satisfactory from the aspect of corrosion-resistance. Under some conditions, lead coatings are employed. Cadmium does not alter the dynamic resistance of the spring but this is noticeably diminished by hot-dip coatings of zinc and tin, it is better to electroplate these metals. In barrel plating, springs tend to become interwoven with each other. Hydrogen embrittlement must be guarded against in the plating of steel springs. Nickel coatings are difficult in this respect. Bath agitation tends to reduce this danger.

Non-ferrous metal springs are not subject to hydrogen embrittlement. The most currently used metal is berryllium-copper with 2% berryllium. These are pickled in 12.5% sulfuric acid, for 1-2 minutes then, to ensure good adhesion of the deposit, the spring is dipped at room temperature in a 1:3 nitric-sulfuric acid bath. After finishing, the spring is plated. If it is not to be plated after the acid pickle, the spring is immersed in a solution of 25 g. sodium dichromate, 0.28 liter conc. sulfuric acid and 1 liter water. The dip is one minute at room temperature. Nickel and tin plated coatings improve the appearance. Gold coatings are applied for electrical applications to prevent tarnishing and to ensure a low contact resistance.

Influence of Thiourea on Copper Plating

S. Y. Popov: *Zhurnal Prikladnoi Khimii* (Russia). Vol. 27, No. 1, p. 55.

Details are given of research on the addition of thiourea to highly acid copper electrolytes of high concentration. There are discussed the results of the investigation on polarization of the cathode and anode, on current efficiency, on the mechanical properties, appearance of the plate, etc. The authors discuss the optimum concentration of the thiourea to be added to the plating bath and the plating conditions to obtain a maximum adhesion of the deposit and a high brilliance. The stability of the thiocarbamide during the electrolysis and the analytical control are considered. Details are given of the possibility of bright nickel plating on a sub-coating of copper without previous polishing, together with the theory of the effect of the thiocarbamide.

Influence of Thiocarbamide on Electroplated Nickel

L. I. Antropov and S. Y. Popov: *Zhurnal Prikladnoi Khimii* (Russia). Vol. 27, No. 2, p. 206.

The authors discuss the possibilities of the production of bright nickel plate by plating ordinary nickel on a sub-coating of bright copper, by a deposit of nickel by means of a solution containing thiocarbamide on a sub-coating of ordinary copper, or by a deposit of nickel from a solution containing thiocarbamide on a base coating of bright copper.

The experimental method is given together with the results. The conditions are also discussed under which one can obtain nickel deposits having a luster and a maximum uniformity. Details are given of the advantages of thiocarbamide as a brightening agent and of its dual action in nickel plating baths. The composition recommended by the authors is given for the bright nickel solutions.

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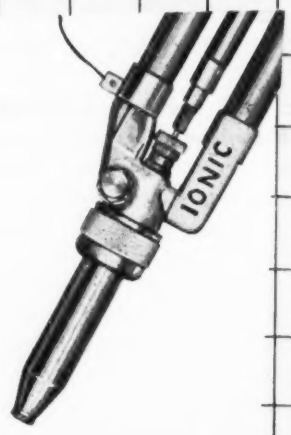
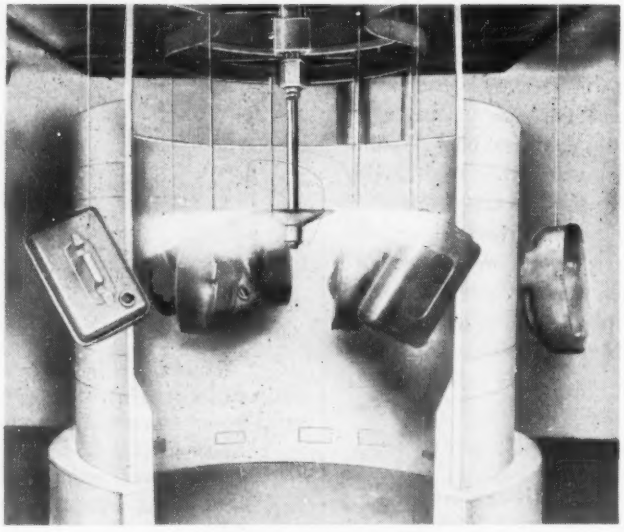


*Patented



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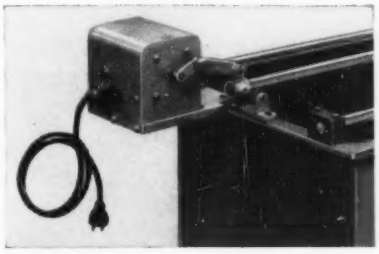
Recent Developments

NEW METHODS, MATERIALS AND EQUIPMENT FOR THE METAL FINISHING INDUSTRIES

Cathode Agitator

Belke Mfg. Co., Dept. MF, 946 N. Cicero Ave., Chicago 51, Ill.



A new rod agitator, for plating printed circuits, costume jewelry, precious metals, small lot work of all kinds, is designed for cathode rods ¾" diameter or smaller. The agitator has a 3" stroke with speed variation from 12 to 29 strokes per minute, and comes equipped with operating cord and plug for 115 V, 60 C, single phase. It is furnished complete with tank or for installation on present tanks. Price is only, $99.50. Dimensions: approx. 8½" wide, 9" long, 5½" high.

65/Circle on Readers' Service Card

Liquid Detergent for Ultrasonic Cleaning

Acoustica Associates, Inc., Dept. MF, 26 Windsor Ave., Mineola, N. Y.

A low-cost, high performance water based detergent suitable for use with all types of ultrasonic cleaning systems, designated Ultrasonic Cleaner No. 715, ordinarily is used in proportions of several ounces per gallon of warm water, the exact concentration depending upon the degree of soil. When used in conjunction with an ultrasonic cleaner of any manufacture, the detergent accelerates the removal of soils in a fraction of the time required with ordinary household detergent solutions presently in use.

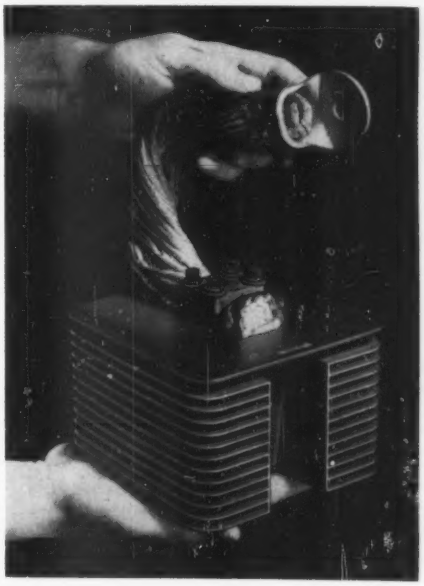
Free pint samples of the cleaner, as well as one gallon packaged containers at a nominal charge, are available upon request to the company.

66/Circle on Readers' Service Card

Germanium Rectifier Junctions

International Rectifier Corp., Dept. MF, 1521 E. Grand Ave., El Segundo, Calif.

Specifically designed for application to heavy duty installations requiring exceptionally high current at low voltage, these 500 amp. germanium power rectifier junctions provide efficiency of 98.9%. The cast aluminum airfoil housing, measuring only 6" x 6" x 4-5/32", removes heat from the all-welded, hermetically sealed junction at an optimum rate; leads to marked economies in space and weight of installed rectifier equipment. Long-



term reliability stems from improved methods in the diffusing of the junction, which is alloyed during the hermetic sealing, without the use of active chemicals.

The junctions are available in six types, with input voltages ranging from 20 to 66 volts rms.

67/Circle on Readers' Service Card

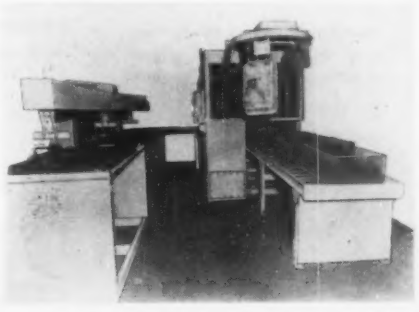
Small Parts Cleaning Machine

Magnus Chem. Co., Inc., Equipment Div., Dept. MF, Garwood, N. J.

This new machine has been especially designed for washing tote boxes and small metal parts of various shapes and dimensions. Loading and unloading of the machine is accomplished at the same end by one operator. Power spray washing is combined with dip-immersion-agitation, assuring that tote boxes and basketed parts are thoroughly cleaned.

Small parts, loaded in baskets, are washed and rinsed using vertical agitation in the two stage Aja-Lif automatic section of the equipment at the rate of 25 baskets per hour. This section uses the dip-immersion-agitation method in which the basketed parts are moved rapidly up and down in the solution, thereby assuring that all surfaces of the work being cleaned are exposed to the action of the various liquids and evenly treated by the solutions. The up and down movement of the parts in the solution scrubs and shears the soils from interior and exterior surfaces of the parts. The basketed parts are automatically transferred from point of loading through the wash and rinse stages to the unloading station. The immersion and agitating period in the wash and rinse stages is controlled by an adjustable timer.

Tote boxes are washed in the power spray washing section of the machine. After transferring the small parts from the tote boxes to the baskets, the operator hangs the dirty tote box on a hook of an overhead conveyor which carries the tote box through the tunnel of the machine, where it is thoroughly washed by high pressure sprays. The machine is so constructed that the washing op-



eration functions only when a tote box is passing through the spray chamber. Contact of the tote box with a control arm energizes the spray cleaning mechanism.

As each basket of clean metal parts returns to the loading stage, a clean tote box is ready at this point for instant loading of the cleaned parts and delivery to the next operation.

69/Circle on Readers' Service Card

Ultrasonic Generator

Branson Ultrasonic Corp., Dept. MF, 40 Brown House Road, Stamford, Conn.

A new ultrasonic cleaning generator for pilot-plant or production application has been designed to simplify manual or conveyorized cleaning and degerasing. The model AP-200 Sonogen generator is 25 x 17 x 19-in. high, weighs 175 lbs., has an average power output of 1 kw with a peak on pulses of 4 kw, and plugs into all standard industrial receptacles. Housed in a gray hammertone aluminum cabinet, it has a simple one-tube pulsed oscillator, a number of heavy-duty components and a cooling fan to insure long trouble-free operation in continuous production.

A flexible 6-foot cable connects the generator to a Type T-360 tank/transducer combination. This 25-gallon capacity unit is the one most frequently used with the generator, although several other combinations can also be driven by it. The welded stainless-steel tank will hold organic solvents, detergent and alkaline solutions, as well as some mild acids. When strong acids are required, they are usually contained in a plastic or glass vessel, which in

turn is coupled to the liquid in the tank.

For custom-built installations or cleaning tanks already in the plant, the generator may be equipped with various sizes of stainless-steel immersible (Type E) or bulkhead-mounted (Type B) transducers.

Transducers with radiating areas up to 360 sq. in. may be coupled in parallel to one generator and mounted along the sides or bottom of a tank for conveyorized processing. Each transducer has its own individual fuse box with indicating lights to show proper operation.

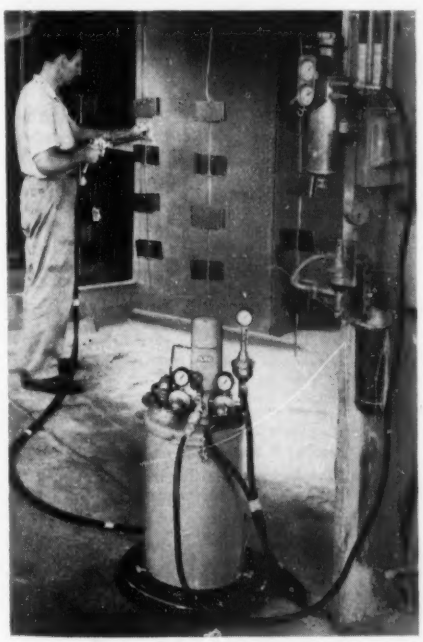
70/Circle on Readers' Service Card

Paint Spraying Equipment

Aro Equipment Corp., Dept. MF, Bryan, Ohio.

A new line of air-operated paint spray equipment for industrial use can be used for spraying lacquers, enamels, synthetics, airplane dope, fillers, varnishes, phenolic, long oil, die drawing compound, metallics, sealers, primers, and many other materials.

Items in the line include a new 4:1 ratio divorced type paint spraying unit in 50-lb. capacity portable units and 400-lb. stationary pumps. These simplified paint units are ready to connect to the air line for immediate use, with no other accessories needed.



Other new products include 2:1 ratio portable and stationary paint units for production use, 1:1 ratio paint transfer pump for transfer of paints, lacquers and thinners; also multi-purpose spray stations, time-saving production line

circulating systems, air hoses, thiokol paint hoses, paint pump and air line accessories.

For indoor or outdoor use, a new steel "Port-A-Paint" stay level cart comes complete with the new 4:1, 50-lb. paint unit. The cart is fully portable and designed to prevent paint from splashing or spilling from container.

All equipment is backed by a one year warranty.

73/Circle on Readers' Service Card

Fire Extinguisher

Safety First Products Corp., Dept. MF, Elmsford, N. Y.

A new three-pound capacity dry powder fire extinguisher with Underwriters' Laboratories listing has an extinguishing efficiency rating equal to eight one-quart vaporizing liquid (carbon tetrachloride) extinguishers.

The small extinguisher measuring only 17½ inches high by 4¾ inches in diameter and weighing 8 lbs. fully charged, is pressurized with 130 p.s.i. nitrogen and charged with especially treated bicorbonate of soda. It can be re-charged at any of the company's 1,800 service units across the country or at any other qualified extinguisher service point.

The one-piece spun steel cylinder meets I.C.C. standards and is hydrostatically tested for 800 pounds with a rupture point of 3,000 pounds. All working parts are brass or bronze. The pressure gauge is marked for instant check on its operable condition; any unreported use is signaled before the emergency of a fire.

Called the "Dri-Power" extinguisher, it can be used on fires where water cannot be used such as electrical and flammable liquid fires as the UL rating of

4 B:C indicates. Propane, butane and other gas fires can be extinguished with this unit. Fires in ordinary combustibles such as cotton lint, fabrics and weeds which are not deep-seated can be extinguished in seconds.

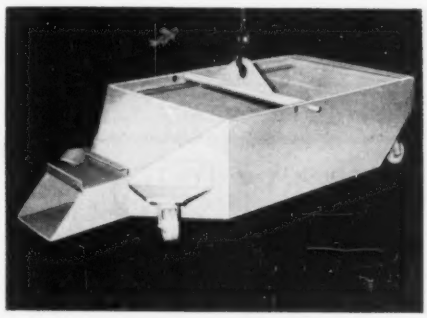
Its light weight and simple mechanism permits one hand operation by a man or woman. The extinguisher is activated by pulling a safety pin and squeezing the double carrying handle. It has an effective range of ten to twelve feet and the powder cloud insulates the operator against heat and flame. The total discharge time under continuous operation of about ten seconds is more than ample to extinguish fires in their early stages.

The extinguishers come equipped with either wall or truck brackets and the recommended retail price for single units is $18.50.

75/Circle on Readers' Service Card

Hopper Pans

Rampe Mfg. Co., Dept. MF, 14915 Woodworth Ave., Cleveland 10, O.



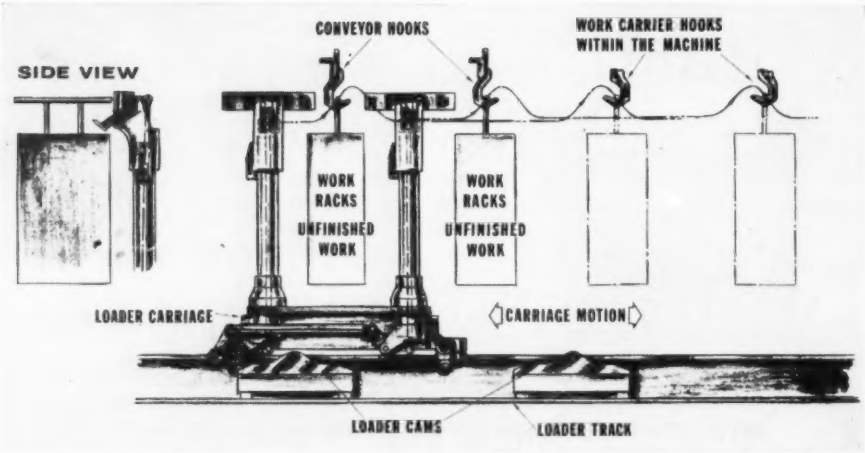
Three new hopper pans to speed loading, unloading, storage and transfer of tumble-finishing media, are of welded steel construction, with ball-bearing wheels, and a balanced yoke for easy transport and lifting. Standard sizes include a one cu. ft. hand-size pan, and 4 cu. ft. and 8 cu. ft. sizes for handling with crane or hoist hook. Typical uses of the pans include hopper loading of steel balls or heavy abrasives from storage bins into tumbling barrels, unloading large capacity machines, and rolling pans from bin to bin in preparing special media mixtures. The pans also are ideally suited for storage and transfer of various media for special applications.

76/Circle on Readers' Service Card

Automatic Transfer

Wagner Bros. Inc., Equipment Div., Dept. MF., 7800 Dix Rd., Detroit, Mich.

This new automatic transfer unit is



designed so it can be operated either hydraulically or electrically. Hydraulic power is used for short carriage strokes, and electric for the longer strokes. All mechanism of the unit, which operates on a track, is confined within the transfer carriage to make a completely self-contained unit.

In operation, the transfer setup in the accompanying sketch, picks up the work from the two conveyor hooks, and transfers it to the work-carrier hooks, upon which the unfinished work is moved out of the loading station by the machine, and the finished work moved into its place. The transfer unit, which dwells during the machine index, then moves to the left, transferring the two finished work racks from the machine work carrier hooks onto the two empty hooks of the conveyor which, in turn, had remained stationary during the preceding motion. The finished work is now indexed out of the conveyor loading station and the unfinished work moved into its place. Then the cycle repeats. This principle also can be easily arranged for handling one rack at a time.

78/Circle on Readers' Service Card

Safety Cleaning Solvent

Harco Chem. Co., Dept. MF, Cranford, N. J.

A new, pleasantly scented, safety cleaning solvent for wipe or dip cleaning of greasy and oily parts replaces carbon tetrachloride and other chlorinated solvents and has no flash point under normal usage. It compares in toxicity to Stoddard Solvent and offers the advantage of high solvent power with extremely rapid evaporation.

79/Circle on Readers' Service Card

Deburring Machine for Long Parts

Speed-D-Burr Corp., Dept. MF, 3613 San Fernando Rd., Glendale 4, Calif.

Speed-D-Burrmatic is an automated deburring machine that promises an entirely new concept in the deburring and surface finishing of extremely long or large bulky parts. It is capable of

finishing parts up to 10½ feet in length in groups of four or even six pieces, depending upon configuration. The parts are held firmly by means of holding fixture (see insert) and lowered by hydraulic power into a preselected abrasive media where a sliding motion through the media completely deburrs or surface finishes to the precise degree required. Then, when the short time cycle is completed, the holding fixture automatically lifts up from the media to a position for easy removal.

With "building block" set-ups in mind, the machine is engineered so that two or more units may be placed tandem to permit the finishing of extremely long parts. For example, two units together could process lengths to 21 feet; three units—lengths to 30 feet, etc. It is almost unlimited in the length of parts that can be finished. With a number of units at hand, broad versatility is possible. Units may be assembled in tandem, disassembled, reassembled to any desired length at any time. In tandem use, perfect synchronization, timing and operation of all units is possible using the master control panel and master actuating switches.

80/Circle on Readers' Service Card

Dust Collector

Aget Mfg. Co., Dept. MF, Adrian, Mich.

A special, extra storage capacity dust collector, Dustkop Model 520-D, is the latest addition to the manufacturer's line. Ten inches higher than the standard model 520, it has identical air handling characteristics and base dimensions, but a dust storage bin that is over twice as large. Base, 18" x 23"; height, 34".

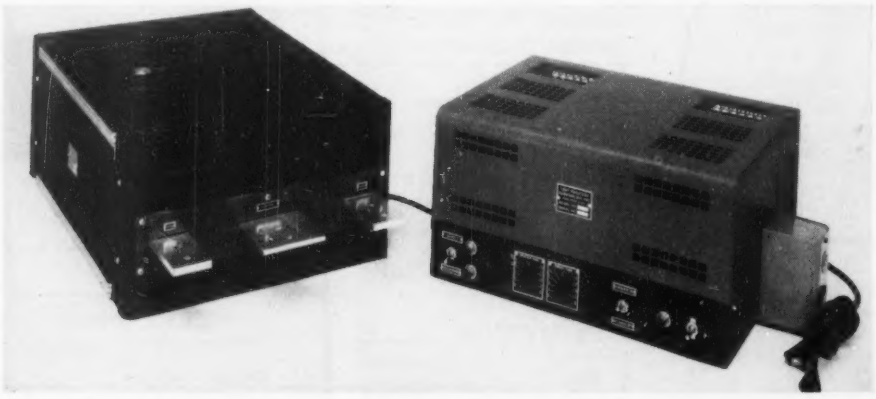
81/Circle on Readers' Service Card

Heavy Current Switch

Unit Process Assemblies, Inc., Dept. MF, 61 East 4th St., New York 3, N. Y.

New developments in heavy D.C. current switching at low voltage are

featured in a new product now being offered. Equipment in capacities from 50 amperes to as high as 35,000 amperes is made available, and features low initial cost, long life and reliability. This solenoid-operated switchgear is offered in a wide variety of switching systems for use with all D.C. rectifiers and generators and can be equipped with timing controls.

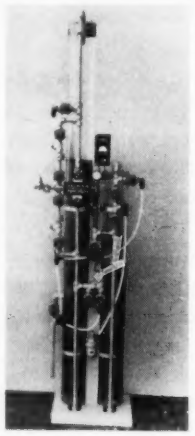


Some of the many applications in industry include: D.C. switching for electrolyte processes; Periodic-Reverse electroplating processes; D.C. polarity reversal in hard chromium plating, alkaline derusting and descaling and electrocleaning; high speed electrotinning lines; and wherever switching or interrupting of heavy D.C. currents is required.

84/Circle on Readers' Service Card

Demineralizer

Penfield Mfg. Co., Dept. MF, 19 High School Ave., Meriden, Conn.



This new mono-column demineralizer features cast acrylic columns for both carbon filter column and ion exchange column. Operating on highly efficient mixed bed ion exchange principles, the unit produces up to 100 g.p.h. of ultra-pure (less than ½ p.p.m.) water. The Plexiglas columns enable the operator to see the action in both columns at all times.

The unit is completely packaged, shipped ready to deliver water upon simple connection to a plant's service lines. Exchange capacity of the resin charge is 18,000 grains and the unit's overall dimensions are 15″ x 15″ x 86″. All piping, valves, screens, eductors, etc. throughout are 100% non-corrosive—either red brass or plastic construction.

Controls for fully automatic operation including signalling when purity falls below a pre-set standard, then automatic accomplishment of a complete regeneration cycle upon the turn of a single switch, are optional equipment.

85/Circle on Readers' Service Card

Wire-Reinforced Steam Hose

Acme Rubber Mfg. Co. Div., Acme-Hamilton Mfg. Corp., Dept. MF, 115 Meade St., Trenton 3, N. J.

A complete line of wire-braid reinforced, burst-proof steam hose for saturated steam service at pressures up to 200 p.s.i., or for superheated steam up to 385 F is now available. Reinforced construction prevents explosive rup-

ture in case of hose failure, adding to plant safety by preventing accidental burns. A neoprene cover provides maximum resistance to heat, abrasion and petroleum products.

W. B. steam hose is built around a tube compounded of special heat-resisting rubber for longer life under high-temperature live steam. Reinforcement is provided by one or two braided plies of high-tensile steel wire, each covered by a layer of heat resistant rubber. High-tensile cord yarn covers the outer layer and aids in bonding the neoprene hose cover. Standard sizes include ½, ¾, 1, 1¼, 1½, 2, and 2½ in. i.d.

86/Circle on Readers' Service Card

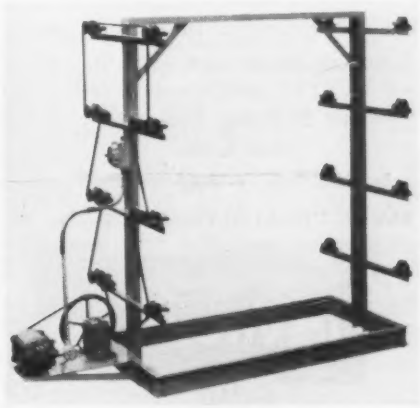
Flowcoating System For Finishing Small Parts

William A. Finkbeiner, Dept. MF, Box 36, Cheltenham, Pa.

A new method for applying air-drying or baking synthetic finishes or lacquers at low cost to small parts, utilizes two units of equipment: a Model 122 Flowcoater with rotating reels designed to hold a variety of small parts by means of spring clips, wires, pegs, or tapered pins; and a Model 814 Rotator to which the reels are transferred after coating.

Use of the same reel to handle the parts through all the stages of the finishing cycle reduces the need for rehandling and reracking during coating, drying, and baking when required. By making use of an appropriate number of reels, the process can be operated on a continuous basis.

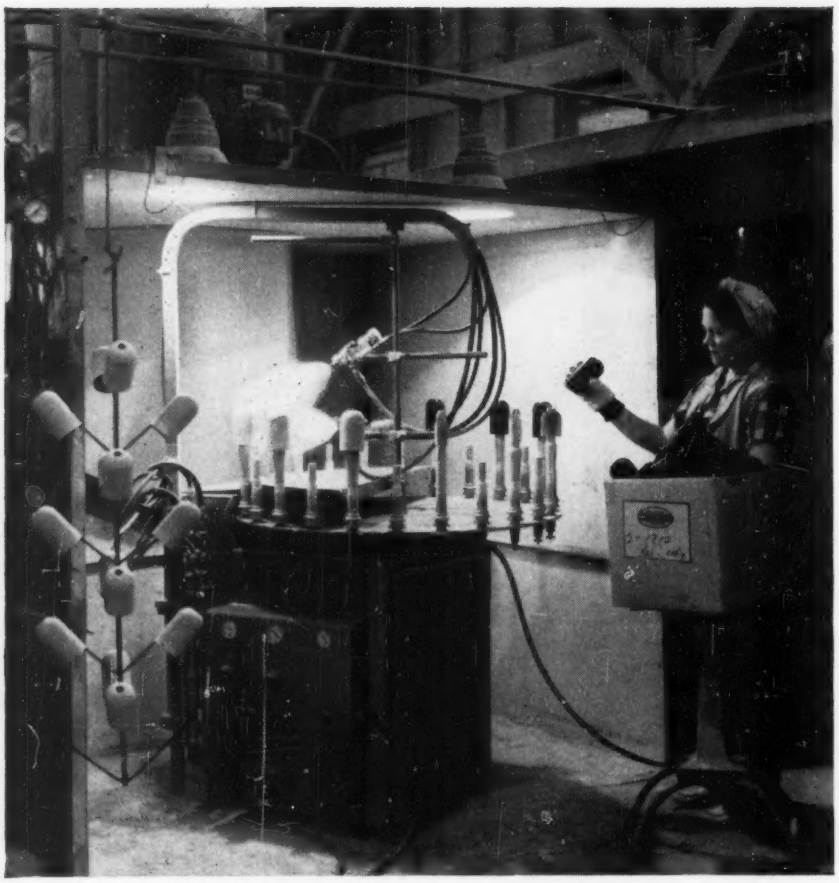
Model 122 Flowcoater



Model 814 Rotator

The unit requires only three gallons of finishing material. This material is pumped from the bottom of the tank through a 25 micron filter and into a horizontal manifold where it cascades from a series of special bronze nozzles onto the reel-mounted parts as the reel is rotated slowly by hand. During this time the flow coating acts as a washing process to remove all lint, dust and other foreign particles from the parts. Approximately one minute in the closed unit provides a solvent-vapor run-out of excess lacquer which drains back to the reservoir for re-use.

After coating, the reel and parts are transferred to the rotator, which accommodates eight reels at a time, each measuring 14" dia. by 55" long. Revolving the reels for about 15 minutes allows the coating to set with an even flow-out of any excess finishing ma-



Automatic DeVilbiss rotary spray machine mechanizes the actual spray operation for absolute uniformity in coverage and quality.

Smoot-Holman triples production with DeVilbiss Automatics

. . . saves $160 each day of operation

The Smoot-Holman Company, manufacturer of fine illumination equipment and plumbingware, in Inglewood, California, sprayed its products by hand for many years. With this method, the finishing department was completing about 900 pieces a day, and averaging 40 pieces per gallon of materials.

Recently, the firm installed DeVilbiss automatic spray guns... and an automatic rotary machine. Now, production has increased to 2700 pieces a day, or 300%, and one gallon of material coats 160 pieces! The result: finishing costs have been cut $160 each day the machine is in operation.

Put the experience and technical skill of a DeVilbiss representative to work for you! A look at your finishing department, and he may be able to suggest improvements that will give you better finishes ... and at lower cost, as well.

THE DEVILBISS COMPANY
Toledo 1, Ohio
Barrie, Ontario • London, England
BRANCH OFFICES IN PRINCIPAL CITIES

FOR BETTER SERVICE, BUY
DEVILBISS

88/Circle on Readers' Service Card

terial, thus eliminating runs, sags, orange peel, and dry areas.

When baking is required to cure the material, the reels can be transferred to an oven conveyor or placed on a wheeled truck for rolling into a batch-type oven.

Both machines employ explosion-proof motors, starters and conduit throughout. Units are assembled and completely wired before shipment.

89/Circle on Readers' Service Card

Spray Mask Pads

Conforming Matrix Corp., Dept. MF, 349 Toledo Factories Bldg., Toledo 2, O.

Positive location and perfect fit of product pieces into spray masks are assured by the use of new nesting pads made of plastic and formed to the part. One of these pads is shown on a standard vertical type air clamping fixture.

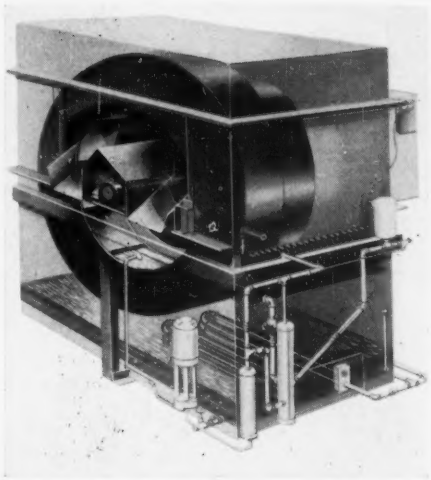
The use of the plastic pads results in the elimination of possible fracturing of finished surfaces, such as chromium, a common occurrence with metal pads with leveling screw bolts.

90/Circle on Readers' Service Card

Automated Degreaser

Detrex Chemical Industries, Inc., Dept. MF, 14331 Woodrow Wilson Ave., Box 501, Detroit 32, Mich.

Greater efficiency and economy in metal cleaning by combining solvent degreasing with automated work handling is provided by the new Model IDD750. This rotary drum degreaser requires only a minimum investment yet fills the needs of a wide range of



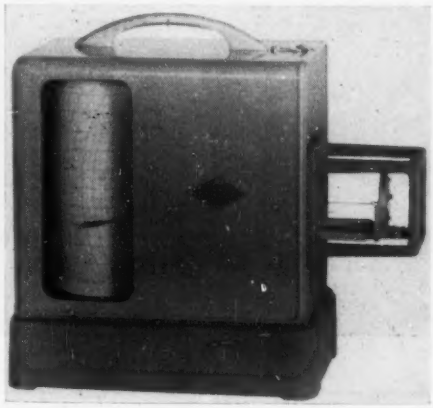
degreasing operations. Steam heated and measuring only 6′6″ wide and 6′0″ high, and 4′0″ in direction of work flow, the unit is compact enough to be readily usable where space is at a premium. It handles five cubic feet per hour with a rated capacity of 2,000 lbs. steel or brass per hour.

Parts to be cleaned enter via a conventional chute. They are carried through the degreaser by a screw-type drum which gently tumbles the parts, subjecting them to vapor and immersion cleaning and final vapor rinse and drying. Parts are then discharged through a chute on the opposite side.

91/Circle on Readers' Service Card

Humidity Recorder

Serdex, Inc., Dept. MF, 91 Cambridge St., Boston 14, Mass.



The Microhygrograph utilizes a specially designed animal membrane, and makes minute fluctuations in relative humidity visible by recording them on an outsize 12″ x 6″ chart. Readings to less than 1% relative humidity are possible. The chart covers a 24-hour period.

No correction charts or calculations are necessary. Nor are piping, wiring or treatment of the sensitive element. The instrument is carefully checked to

assure ±3% accuracy at all times. Operating range is 15% to 95% relative humidity at temperatures from 32°F. to 130°F. At temperatures below freezing, a correction chart is used.

93/Circle on Readers' Service Card

Plastic Type Protective Coating

Mono-Seal Products, Dept. MF, 44 Garden St., Everett 49, Mass.

A new supertough, plastic-type protective coating formulated from a special blend of silicones and epoxies, is claimed to have demonstrated outstanding properties for corrosion resistance, impact resistance, long life and weather and moisture resistance. Mono-Seal has a natural "stretch," and it will not chip or peel when bent or dented.

The material is described as a balanced chemo-setting synthetic resin coating containing silicones and epoxies. It contains no plasticizers or oils that normally cause saponification or progressive age embrittlement and deterioration in the more common coatings. It cures both by solvent evaporation and internal polymerization, yielding a surface finish with greatly increased molecular weight and extremely positive bond and surface hardness characteristics.

The non-aging properties and extreme surface hardness and elasticity provide the type of coating that will protect against the widest possible range of acids, alkalies, oils, solvents, plasticizers, moisture, weathering, abrasion, impact, and temperature extremes.

This protective coating comes in a three-part package consisting of resin, activator and thinner, each furnished in separate cans with complete instructions for use. It is then mixed according to method of application and desired film thickness. Brush, spray or dip methods of application may be used as required. Drying and curing times are very favorable and successive coat operations may be performed in a shorter time cycle than with conventional coatings, it is said.

The coating is available with a selection of twenty-two standard colors and clear. Special colors can be matched. Gloss finish is stocked and semi-gloss and flat are available on special order.

94/Circle on Readers' Service Card

Plastisol Primer

Dennis Chem. Co., Dept. MF, 2701 Papin St., St. Louis 3, Mo.

Denflex No. 2394-1 White Primer bonds plastisols to metal to form coatings which withstand immersion in cold or boiling water and exposures to conditions of high humidity. It is supplied at a viscosity suitable for roll coat application; if thinned, it can be brushed,

to be individually masked. The materials are mostly used on dials for appliances and name plates.

The new material, X-134 series, is said to be exceptionally fast in dry time and sets to maximum hardness in two days. It can be used on most plastics, either first or second surface, without causing haze or etch. It can be used on either automatic or hand equipment. Standard dry wipe colors are black or white.

96/Circle on Readers' Service Card

Emulsion Cleaner

Parke-Hill Chem. Corp., Dept. MF, 29 Bertel Ave., Mount Vernon, N. Y.

A new, water emulsifiable degreasing compound, Grease Ban, can be used either full strength or diluted with kerosene to remove oils, grease, and dirt. Applied in proper strength for the job, it is simply washed off with water, without leaving an oil film on the object cleaned.

97/Circle on Readers' Service Card

Plating Timer

Cadillac Rectifier Div., R.E.P. Electric Prod. Co., Dept. MF, 539 Webster Ave., New Rochelle, N. Y.

The above manufacturer has enlarged its line of Cyclomatic automatic plating timers to include capacities up to 6,000 amperes. Timing ranges are from 1/4 second to 3 hours.

98/Circle on Readers' Service Card

Chelating Agent

Marathon Corp., Dept. MF, Rothschild, Wis.

Preliminary laboratory tests with Maracarb N have indicated that this product may be useful in metal cleaning operations. Alkaline solutions of the material remove dirt and oil films from metals and, by chelation, put tarnish and oxides into solution without harming metal.

The product is a complex mixture of the sodium salts of lower molecular weight lignosulfonic acids and salts of

flow-coated or sprayed. The primer requires a minimum of pre-heat before application of the plastisol and, even after baking, is light in color; it will not show through thin coats of pastel colored topcoats. No. 2394-30 Yellow Primer, in addition to its superior bonding quality, provides resistance to salt spray and salt water immersion.

95/Circle on Readers' Service Card

Dry Letter Fill

Logo, Inc., Division, Bee Chem. Co., Dept. MF, 12933 S. Stony Island Ave., Chicago 33, Ill.

A new high speed dry wipe and letter fill material dries to a powder and can be quickly and easily removed from surrounding areas after the letters are filled. Dry wipes are usually used on areas too small or intricate

alkaline reversion products of hexoses and pentoses. Aging the solutions for one week produces very little drop in the electronegative potential capacity, indicating a long life in metal cleaning baths.

101/Circle on Readers' Service Card

Associations and Societies

AMERICAN ELECTROPLATERS' SOCIETY
1958 Convention

Addabelle Miller (Mrs. Robert D. Miller) and Bunt Young (Mrs. William Young) will be chairman and co-chairman respectively of the Ladies Committee in conjunction with the annual convention of the American Electroplaters' Society, to be held at the Sheraton Gibson Hotel, Cincinnati, Ohio, May 19-22, 1958.

Addabelle Miller

Bunt Young

They recently announced that their program is almost complete. It will include the usual activities that form a part of the general program such as the Sunday night opening reception, the big MFSA Open House on Monday, the outing and annual banquet, plus events for the ladies only. Among these will be the Plato party, Joan T. Wiarda, hostess, sightseeing trips, fashion shows and luncheons.

Cincinnati and the surrounding area is most attractive in mid-May, making it an ideal location.

Saginaw Valley Branch

The Saginaw Valley Branch held their regular meeting at Zehenders Hotel in Frankenmuth, Mich. on October 9, 1957. Members and guests from Dow Chemical, General Motors Research, Metal and Thermit, and Oldsmobile enjoyed a ham dinner.

"Mechanism of Corrosion of Plated Coatings" with particular emphasis on chromium plate was the lecture topic of the evening. *Richard Fellows*, of the Udylite Research Corp., gave the talk from a paper prepared by *Dr. H. Brown*. *Don Millage* assisted Mr. Fellows with the slides.

Leo Mangett won the door prize donated by *Charles Auger* of the Metalwash Corp. *Art Medwedeff* showed two films on Michigan to conclude the activities.

P. A. Waskevich,
Recording Secretary

Chicago Branch

The technical program, for the October meeting, which was held on Friday, October 4, 1957, was a symposium on "Precious Metal Plating". The speakers were *Frank Smith*, Technic Inc.; *Edwin Rinker*, Sel-Rex Corp.; and *Roger Zylstra* of the Ford Motor Co., Air-Craft Engine Division, Chicago.

The first speaker of the evening was Mr. Frank Smith who talked on "Gold Plating", and discussed the various metals such as nickel, cobalt, silver, which were added to gold baths to obtain certain physical properties. Mr. Smith also discussed the various uses of gold-alloy plate for the electronic industry.

Mr. Rinker gave a talk on "Rhodium Plating", and also discussed the various alloy-gold baths developed for specific applications in the electronic and electronic-aviation fields.

Mr. Zylstra gave a talk on "High Speed Silver Plating." With the use of slides. He discussed the various parts which were silver plated for use in the jet-engine. The talks were very well received by the members and a very good question and answer period followed.

Christopher Marzano,
Publicity Chairman

Newark Branch

The Oct. 18 meeting was called to order at 8:00 p.m. with about 50 members present. Three applications were accepted for action and *Sidney Klein* of Chemclean Products Corp., *Joseph Miller* of Bart Laboratories, *Charles Ott* of C. R. Ott Instrument Co., *William Szekely* of Wright Aeronautical Corp., and *George P. Shaw* of Bellis Equipment Co., were elected to membership. *Gus Bittrich* reported on the Annual Banquet and asked the members to state their feeling re organic finishing on the bottom of a program evaluation slip distributed to all present. *Don Foulke* introduced visitors *Franklyn MacStoker*, past A.E.S. president, *Milt Nadel*, secretary of the New York Branch, and *Plating* Editor *Rodney Leeds*. Newark Branch members introduced as luminaries in the metal finishing field were *John Nichols*, A.E.S. executive secretary, *Andy Wesley*, A.E.S. third vice-president, *Pete Kovatis*, N.A.M.F. secretary, and *Bob Ehrhardt*, chairman of the A.E.S. Research Committee.

Librarian *Fred Meyer* then presented *Marv Rubenstein* and *Jesse Lane* of Marlane Development Co. Mr. Rubenstein first described the Dalic Method noting three differences from old brush plating techniques as improved solutions, special brushes (styles) and broadened engineering applications. He showed a number of slides explaining the process, the styles used, baths and properties of deposits. Mr. Lane then demonstrated how the process worked, plating a number of samples of all types including steel, aluminum, etc., using a rectifier and equipment brought to the meeting room for this purpose. A spirited question and answer period attested to the interest in this specialized, engineering method of plating.

D. Gardner Foulke,
Secretary

Detroit Branch

The second fall meeting of the Branch was held at the Statler Hotel in Detroit on October 4, 1957. President *Glenn H. Freidt, Jr.*, opened the meeting at 8:25 P.M. and greeted the 115 members and guests present. *Ed Kubis*, secretary-treasurer, read the names of 23 applications for membership to the branch, and they were unanimously accepted.

Doug Thomas, educational chairman, introduced the technical chairman of the evening, *Don Bigge*, managing engineer, Engineering Lab. at Chrysler Corp. Don introduced the speaker of the evening, *Walter Pinner*, Houdaille-Hershey Industries, Detroit,

with one of the most enlightening introductions heard in a long time.

Mr. Pinner, chairman of Committee B-8, presented his report of ASTM activities on performance of plated coatings. He broke down the 5 sub-committee groups of B-8 and told of present activities of each sub-committee. A number of slides were shown, showing various types of Cu, Ni, and Ni-Cr, panels plated and the various rates of corrosion indicated as exposed at Kure Beach, Florida, Pittsburgh, and Detroit. After a very interesting presentation, a lively question and answer period followed.

It was mentioned that the A.E.S. Executive Board had agreed that the educational program of the 1959 convention would be "The 5th International Conference on Electrodeposition and Metal Finishing sponsored by the Golden Jubilee of A.E.S.".

The meeting adjourned at 9:45 P.M. with refreshments served.

Robert J. Amis
Publicity Chairman

Los Angeles Branch

Bert J. Sherwood, president, Chemplate Corp., Los Angeles, presented a talk on "Electroless Nickel Plating" before 100 members and guests at the October 9 meeting of Los Angeles Branch. The wide interest in the talk was due to the fact that more work in electroless nickel deposition is being done at present in Southern California than in any other area of the country.

Sherwood, a member of the Branch, has done much pioneering work in the field. His firm began such work in a small 4,000 square foot plant about five years ago and, several months ago, moved into an 18,000 square foot production plant.

In his October 9 talk he presented the subject not only from the viewpoint of application and use, but also from the viewpoint of detailed processing required to produce the desired results on various shapes and materials.

President *George Magurean* presided over the business session from 7 to 8 p.m. The first move was undertaken at this meeting to obtain for *John Merigold*, retired precious metal plater, the long-deserved prestige of honorary A.E.S. membership. Upon motion of *Earl Coffin*, seconded by *Don Bedwell* (both of whom, like Merigold, are charter members of Los Angeles Branch) honorary life membership in the branch was conferred upon Mr. Merigold by unanimous vote. His name will be presented by branch delegates at the next national convention as a candidate for honorary membership in the supreme society. Three Los Angeles members previously so honored were Mr. Bedwell and the late *Ernest Lamoreaux* and *Frank Ruston*.

Emmet Babcock, *Truman Stoner* and *Earl Arnold* were elected delegates to the 1958 national convention. Alternates are *Tony Stabile*, *George Hetz* and *Frank Virgil*.

Lawrence O'Neil, chairman of the publications committee, reported on progress being made for a handbook to be issued by the branch in time for the 1960 convention in Los Angeles. It is contemplated to print about 1,000 copies, to be distributed to branch members and at the convention. Tentative plans are to pattern the forthcoming booklet after the one issued by the branch in 1949, in format and type of editorial and statistical content.

Blue Ridge Branch

The Blue Ridge Electroplaters Club met at Harold's Restaurant, Friendly Shopping Center, Friendly Road, Greensboro at 6 p.m. on October 4, 1957. Twenty-five members and visitors were present.

A report on A.E.S. Chapter progress was made by *Carl Witherspoon* for *Nelson F. Murphy*, first vice-president, that the only steps remaining

were to determine former chapters when transferring members. Delay was due to discrepancy of records between chapters and national office.

The speaker of the evening was *J. B. Winters*, president of Incar, Inc. and first vice-president of Cleveland, Ohio Branch. Mr. Winters gave a talk and led discussion of bright zinc and cadmium plating on a non-technical level.

Miss Shirley Guthrie, of Brame Textile Machine Co., made name tags for all attending and aided with registration.

Carl A. Witherspoon
Secretary

Waterbury Branch

The October business meeting was held Thursday evening, October 3rd, at the home of Secretary *Albert Griffith*, Cheshire, Conn. The meeting was well attended. President *Spencer Henn* opened the meeting at 8:15 p.m. and named the members of the By-Laws Committee: *T. Voyda*, chairman, with *W. C. Giesker* and *E. B. Washburn* assisting. Branch delegates named to the 1958 New England regional committee meetings were *A. G. Griffith*, *F. Tirendi*, and *I. Cross*. The responsibility of the Waterbury Branch at the 1958 Regional Convention will be to present the educational program.

February 13, 1958 was set for the Sustaining Members' Night and the chairman was instructed to start publicizing this date. *I. Cross* volunteered to work with *Ray Mitchell* in planning the program for the evening. *Lou Poretti* was named Chairman of the Committee for the Christmas Party. Assisting him will be *Frank Schneiders* and *Michael Orient*. They were instructed to start immediately on this affair and to plan and organize a real good party.

The regular monthly meeting was held October 10, 1957 at the Hotel Roger Smith. The dinner was held at 6:30 p.m. and the educational program started at 8:00 p.m. The meeting was opened by *President Spencer Henn*, who gave a brief review of the business meeting and then turned over the meeting to Technical Chairman, *Perry Sloane*. The movie "Bethlehem Steel" was shown and was very interesting.

Mr. Sloane then introduced the speaker, *Frank Schneiders*, sales engineer for Enthone, Inc. His subject was "Rectifiers—The Inside Story." He demonstrated and described each functional part of a rectifier and showed the effect of these parts on the current.

Three new members were elected to the Society: *Malcolm Eddy*, Technicraft Labs.; *Charles Deninger*, Oakville Co., Div. of Scovill Mfg.; *David Stango*, American Brass Co.

Nicholas Topazio
Publicity Director

Indianapolis Branch

The Columbus members of the Branch were hosts for the October 2, 1957 meeting. Fifty seven attended with their leading ladies at Arvin's Central Park Cafeteria in Columbus, Ind., to enjoy a delicious steak dinner. *Bert Hawhee* led the introductions and then asked for the minutes of the special meeting called September 30. Minutes were read and accepted concerning the change of the January schedule because of the joint National AES Interim Meeting.

Mr. Hawhee then introduced *Ralph (Duke) Wysong*, who was the special guest for the evening. *Dr. A. Max* has eight signed up for the electroplating class but needs 16 before Purdue Extension will sponsor the class. *John Holland* then announced the main attraction of the evening which was an escorted tour through the Hamilton Mfg. Co. plant on South Gladstone.

The motor caravan found their way over to a large parking lot alongside the plant. The Hamilton Mfg. Co.

makes the Casco line of household metal furniture, and also office equipment chairs. The night shift represented more than half of the normal working plant capacity. The plant buildings cover 12 acres, under one roof. Material is received on the east side, flows through the processing, and is packed and shipped out on the west side, where there is a railroad siding to hold 13 box cars inside the plant. The surprising part is that this company is only about eleven years old. Electroplaters did get to see automatic platers and the very latest painting equpiment too.

Paul Freeman
Secretary

Society of Vacuum Coaters Formed

The *Society of Vacuum Coaters* was formally launched at an organizational meeting and technical conference held at the Hotel Statler, Cleveland, Ohio, on October 30th & 31st. Those attending the first business meeting passed on the work done by committees in drafting a constitution, setting up membership standards and proposing a slate of officers.

Heading up the new group as president is *T. J. LaBounty*, associated with Logo, Inc. of Chicago. The vice president is *Chester G. Northrup* of Consolidated Electrodynamics Corp., Rochester, N. Y.; secretary is *R. G. Lux* of the Lamp Wire and Phosphors Dept., General Electric Company, Cleveland, Ohio; treasurer is *Lee B. Storms*, Red Spot Paint & Varnish Co., Inc., Evansville, Ind.

In addition to the officers, an executive board of six was elected for terms up to three years. These are: *Burton C. Hineline*, Haloid Corporation; *James R. Sims*, Delco Remy; *Frank Dalton*, Vac Art; *Charles Matilo*, Vacuum Metallizing, Inc.; *M. S. Adler*, F. J. Stokes Corp.; and *Howard Farrow*, NRC Equipment Corp.

To get the society launched, the membership committee has set up a schedule of dues, charges to be reviewed at the end of the first year. Two classifications of membership are planned at the outset, with a possible student category to be added at a later date. Charter memberships to firms supplying equipment, lacquer, filaments and other items will be offered at $100, which includes the dues of one designated voting member. Additional individual memberships are $10. Voting rights are limited to one per company or division thereof. Processors can become charter members for $10 annual dues with additional individual members at $10. As with the equipment and material classification, voting rights are limited to one member per company or division. Application forms will soon be available from the secretary.

The next annual meeting will be held in Detroit, Mich. during October or November 1958. This city was selected due to the increased interest in vacuum coating by the automotive industry. Papers to be presented at this time are now desired in the following lines of interest: (1) laboratory research, (2) production techniques and (3) papers of general interest.

A committee was appointed to work on some standards for vacuum coated finishes and to revise the antiquated nomenclature now in use. A discussion brought out the feeling that there was a great deal of work to be done along these lines and that the committee should represent all the elements of the industry — batch processors, equipment manufacturers, lacquer and filament people.

Papers presented at the technical conference included: "The Relationship between Mean Free Path and some of the Faults in Evaporative Coatings", by *Theodore H. Crane*, High Vacuum Corporation; "Racking and Masking Techniques for Metallic Disposition by

Hi-Vacuum", by *J. Gordon Seiter*, F. J. Stokes Corp.; "Refrigerated Vacuum Pumping", by *Howard Farrow*, NRC Equipment Corporation; "Vacuum Deposition of Functional Coatings", by *Chester G. Northrup*, Consolidated Electrodynamics Corporation; "Tungsten Filaments", by *Ralph Ranger*, Sylvania Electric Prods., Inc.; "Lacquering Techniques for Vacuum Metalizing on Metals and Thermosetting Plastics", by *M. A. Self*, Logo, Inc.; and "Lacquering Techniques for Vacuum Metalizing on Thermoplastics," by *Morgan Jones*, Red Spot Paint & Varnish Co., Inc.

BUSINESS ITEMS

Hooker Makes New Appointments

A change in organization of staff as well as several staff appointments have been announced by *Hooker Electrochemical Co.*, Niagara Falls, N. Y.

David S. Rosenberg has been appointed manager of process improvement and development, heading a new group formed to study and improve existing chemical processes as an arm of the research and development department. The new group initially comprises eight chemical engineers transferred from operations and process study.

James E. Dillman is appointed technical supervisor, process study. He will supervise three men remaining in that group, of which he has been a member. *Dr. Elliott P. Doane* is named supervisor, pilot plant, replacing Mr. Rosenberg and reporting to *Joy E. Beanblossom*, manager of development. Dr. Doane has been an engineer in the pilot plant. *Benjamin W. Hancock* is appointed technical foreman of Area 4, the area where Oldbury products are manufactured.

American Buff Co. Marks Its 22nd Year with Party, Gifts For Employees

Celebrating their 22nd anniversary on Sunday, Sept. 15, 1957, employees of the *American Buff Co.* toasted their company's growth at a special party.

In a short talk, Chairman of the Board, *Ben P. Sax* traced the company's history and, following his annual custom, presented each of the company's employees with a canvas money bag containing 22 silver dollars, one for each year of the company's existence.

Stoddard Appointed Neilson Chemical Southeastern Representative

Willis Stoddard has been appointed direct factory representative of the *Neilson Chem. Co.*, Detroit to work with the F. H. Ross Co. in Charleston, N. C., southeastern distributor of the manufacturer.

Walberg to Head New Electrostatic Paint Spray System Division for H. G. Fischer & Co.

Arvid C. Walberg has been appoint-

ed manager of the new *Electrostatic Paint Spray Systems Division* of *H. G. Fischer & Co.*, Franklin Park, Ill. Mr. Walberg was one of the pioneers in the development of electrostatic paint spraying ten years ago and has since specialized in that field. Today he is one of the outstanding engineers in designing conveyorized electrostatic paint spray departments for industrial plants.

Arvid C. Walberg

Haveg Acquires Lithgow Chem. Co.

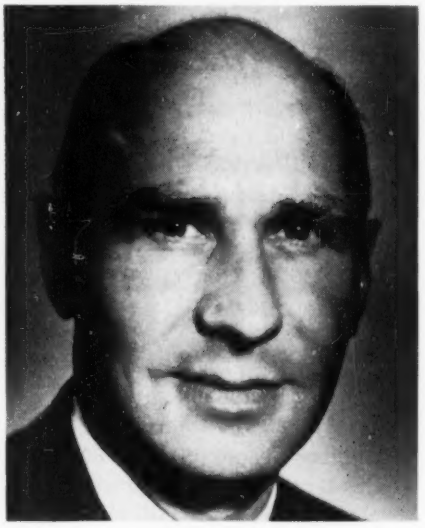
Haveg Industries has announced the acquisition of the *Lithgow Chem. Co.* of California, manufacturers and applicators of a wide range of chemical corrosion resistant plastic coatings, cements, impregnations, and laminated linings.

By this acquisition, Haveg has greatly broadened its line of coatings as well as providing substantial new production facilities on the Pacific Coast. The Lithgow organization will be operated as a division of Haveg.

Baur Appointed Director Of Engineering and Research At Binks

The appointment of *John Baur* as director of engineering and research has been announced by the Binks Mfg. Co., Chicago. The directorship is a newly established position at the company, and was created to aid in coordinating the work of the company's various research and engineering divisions.

Mr. Baur has been with the firm since 1941.



John Baur

Wiretex Appoints Indiana Representative

Appointment of the Kokomo, Indiana firm of *Stout & Loman* as its exclusive Indiana representatives has been announced by *Wiretex Mfg. Co., Inc.*

Founded in 1953 by *Morris S. Stout* and *John K. Loman*, the firm is well known in the heat treating field. Their specialty is the representation of lines used in automotive and industrial plants.

John S. Stout

Acoustica Appoints Three Representatives

Acoustica Associates, Inc. has named the following companies and representatives to represent them in designated territories:

Robert C. McKinney, of Allied Components, Inc., P. O. Box 10203, Dallas 7, Tex. for Oklahoma and Texas.

N. H. Rogers, Puro Chemicals, Inc., 1643 St. Clair Ave., Cleveland 14, Ohio, for the cities of Toledo, Cleveland, Akron, Youngstown, Canton, Mansfield, Lima and their outlying territories, with the exception of Columbus, Dayton, Cincinnati and the counties of S-107.

Don R. Lind, 135 North Terrace Drive, Wichita 8, Kan., to be representative in Kansas, Colorado, Missouri and New Mexico.

New Personnel Appointed By Hodag Chemical Corp.

Dr. Ephraim Kaplan and *George Londos* have joined the staff of *Hodag Chemical Corp.*, Chicago manufacturers of antifoams and other surface active agents.

Dr. Kaplan will assume duties as

Dr. Ephraim Kaplan

George Londos

director of research and development. Mr. Londos, research chemist, will concentrate primarily on the manufacture and application of special surface active agents.

Additions at Kelite

Four persons have been added to *Kelite Corp.'s* research and development laboratories in Los Angeles, according to an announcement.

New appointees are *Morton Schwartz*, senior electrochemist; *Fred Larsen*, physical chemist; *Bruce Davis*, inorganic chemist; and *Ronald North*, senior analytical chemist.

Pfandler-Permutit Consolidation Completed

Legal papers of consolidation were filed September 30 in the Office of the Secretary of State of Delaware and Department of State of New York. Stockholders of Pfaudler and Permutit overwhelmingly approved the merger of the two companies by vote at a meeting held on September 16, 1957.

No immediate changes are contemplated in functional operations of either Pfaudler or Permutit, and each will operate under its previous name as a division of *Pfaudler Permutit, Inc.*

Pfaudler with headquarters at Rochester, N. Y., has been a producer of glassed steel and alloy equipment for the chemical, dairy, food and beverage industries since 1884. Permutit, dating back to 1913, manufactures ion exchangers, chemicals for water conditioning and other applications and engineers, designs and fabricates equipment and provides complete water conditioning and recovery systems.

Metalweld, Inc., Announces Promotions

Metalweld, Inc., Philadelphia, Pa., has announced the appointment of Vice-President *S. John Oechsle, Jr.* to executive vice-president of the corporation. *Kenneth G. LeFevre*, formerly sales manager of the Protective Coatings Division, has been made vice-president of the firm.

Smith Promoted at Mystic Adhesive Products, Inc.

Appointment of *Robert D. Smith* as vice-president and general manager has been announced by *Mystik Adhesive Products, Inc.*, Chicago. A graduate of the University of Illinois, Smith was a member of the Chicago firm of Arthur Young and Co., accountants

and auditors, from 1937 to 1942. He served as an officer in the Navy until early 1946 and shortly afterwards joined Chicago Show Printing Co. as comptroller. In 1951 he was elected a director of Mystik, which was then being operated as a division of Chicago Show Printing Co. and, in 1953, he was named vice-president.

Smith will be responsible for the direction of the integrated production and marketing activities of the company, which was formed as a separate concern January 1, 1957. He will have jurisdiction over the bulk adhesives plant in Northfield and the tape manufacturing plant on Chicago's West Side, as well as one of the industry's most active research and development divisions.

Raffi and Swanson Sales Meeting

The annual meeting of the *Raffi and Swanson* sales department was held on October 29th and 30th. The entire meeting, conducted by *Harry Duston*, sales manager, met with enthusiastic response by all in attendance.

Presentations and discussions consisting of "brainstorming," introduction of new products from the research department, and review of additional and improved manufacturing facilities, including most up to date safety innovations, keynoted the meeting.

The entire sales force and key personnel from management, research and production attended the business meeting held at the company offices in Wilmington, Mass. and the dinners at the Winchester Country Club.

Chromalloy Appoints H. & W. Foege

Announcement has been made by *Chromalloy Corp.*, White Plains, N. Y., that the *H. & W. Foege Co.*, 907 Seward St., Evanston, Ill., has been appointed field representative for the Northern Illinois and Western Wisconsin area.

Aluminum Anodizing in New Location

Aluminum Anodizing Co. has moved to its new plant at 3630 N. W. 76th St., Miami, Fla. *Fred M. Carlson*, president, states that it is one of the most modern and advanced mass production job shops in the anodizing field.

Fred M. Carlson

The firm offers complete anodizing service for all types of aluminum products.

Jomac Appoints Sawyer

Charles H. Sawyer has been appointed sales coordinator for North polyvinyl chloride products by *Jomac, Inc.*, Philadelphia, Pa. The firm was recently organized by Jomac, and *James North & Sons, Ltd.*, London, England. The products are coated work gloves, aprons, chemical resistant clothing and foul weather garments.

Sawyer has had more than ten years experience in the protective and foul-weather clothing fields. He was formerly president of Sawyer Safety Products Co., a firm he founded in Port Chester, N. Y. Previously he had been sales director, then vice-president, of H. M. Sawyer & Son Co., a firm founded by his grandfather.

Slipiec Appointed Representative of Geigy

Roy E. Slipiec has recently been named Midwest sales representative of *Geigy Industrial Chemicals*, a division of the *Geigy Chem. Corp.*, Ardsley, N. Y. His sales headquarters are located at 629 W. Washington Blvd., Chicago, Ill.

Mr. Slipiec attended Wright Jr. College, the University of Illinois, and Roosevelt University, of which he is a graduate. He was formerly associated with the Gallowhur Chem. Corp. of Ossining, N. Y. and the Movidyn Corp. of Chicago. He is a veteran of World War II during which he served with the Army Medical Corps in the South Pacific. Mr. Slipiec holds a commission with the United States Health Service.

H-VW-M Names Muscarella Sales Representative

Joseph Muscarella has been appointed sales representative for *Hanson-Van Winkle-Munning Co.* in the Kentucky-Tennessee area. His headquarters will be at 366 Francis Bldg., Louisville, Ky.

Prior to his appointment, Mr. Muscarella spent four and a half years as sales engineer, general equipment, in the company's main office at Matawan. He has a background in barrel and general plating equipment sales. A

Joseph Muscarella

member of the A.E.S., he studied at Rutgers University.

Raffi and Swanson Appoints Menges

Raffi and Swanson, Inc., Wilmington, Mass., announces the appointment of *Gordon W. Menges* to the sales department, in charge of new product de-

Gordon W. Menges

velopment. This new position has been created in order to better evaluate and introduce the new products coming out of the company's research department.

Mr. Menges' background includes broad experience in the industrial finishing field with Hilo Varnish, Carpenter-Morton, Hercules Powder and Sherwin-Williams.

Armour Appoints Hotelling

Gail Hotelling has been appointed sales supervisor, *Armour and Co., Coated Abrasives Division*, Alliance, Ohio. He will supervise sales for both industrial coated abrasive products and retail products.

Prior to his present association he was in a selling capacity with Bos Hatten, Inc. He is a graduate of the University of Buffalo and the Dale Carnegie Institute of Public Speaking. Mr. Hotelling served in the U. S. Army Air Corps from 1941 to 1943.

Einhorn Elected President of Color Guild Associates

At its annual September meeting in San Francisco, *Ben Einhorn*, head of the *Adelphi Paint & Color Works* of Ozone Park, N. Y., was elected president of the Color Guild Associates. He succeeds *Joe Harryman* of the Olympic Paint & Varnish Co. of Los Angeles, who becomes the group's board chairman.

The Guild's new president reports that a fast moving comprehensive program for the next year has already been initiated from the groundwork laid at the annual meeting. From this new program will stem many new technical and promotional developments that should prove of considerable benefit to all dealers selling the Color Guild Tube System.

As a result of the dynamic effort exerted by the numerous Guild members during the past few years, it has become one of the nation's largest and most influential associations of independent paint manufacturers.

Included among those attending the recent meeting were the president and top executives of the California Ink Co., world's largest producer of paint tube colors for more than 150 paint manufacturers here and abroad.

Ansul Chemical Elects VanderWall Vice President

Clifford C. VanderWall has been elected vice president in charge of manufacturing of the *Ansul Chemical Co.*, Marinette, Wisc. He will continue to direct all the chemical and mechanical operations of the company. Joining

Clifford C. VanderWall

the firm as a member of the engineering department in 1946, VanderWall became director of manufacturing in 1955.

He belongs to the American Society of Mechanical Engineers, the National Society of Professional Engineers and Phi Tau Sigma, the national mechanical engineering honorary society. He is a Registered Professional Engineer of Wisconsin and a director of the Northland Chapter, Society for the Advancement of Management. He was graduated from the University of Wisconsin with a B.S. degree in mechanical engineering in 1939.

Dr. Stiegman and Dr. Brown Receive New Appointments at Hooker

Dr. Clarence A. Stiegman has been named technical director and *Dr. J. Howard Brown* general manager, Niagara research and development, at *Hooker Electrochemical Co.*, Niagara Falls, N. Y.

The company has accepted with regret the resignation of *Dr. Johannes H. Bruun*, director of research and development, effective October 23.

Castles Appointed by General Electric

John T. Castles has been appointed sales manager for the Silicone Products Department of the *General Electric Co.* Formerly manager of rubber market development, Mr. Castles succeeds *Jerome T. Coe* who has become the department's marketing manager.

Mr. Castles came to the firm's silicone operation in 1947 after obtaining his Master's degree in Chemical Engineering from M.I.T. His previous assignments in the department include those as manufacturing engineer, plant manager, and manager of technical service.

He was graduated from Virginia Polytechnic Institute in 1941 and served more than four years in the U. S. Army, attaining the rank of Captain. He is a member of the American Chemical Society, the American Institute of Chemical Engineers, and the Society for the Advancement of Management.

John Hackett Joins Kolker Chemical Corp.

John Hackett, formerly North Jersey sales representative for *Monsanto Chemical Co.*, has been named assistant sales manager of *Kolker Chemical Corp.*, Newark, N. J. In his new post, Mr. Hackett will help handle sales of chlorinated solvents, methylene chlor-

ide, chloroform, methyl chloride, phosphate esters, tricresyl phosphate and the complete line of the company's plasticizers.

Permacel Changes Name to Fit Expanded Activity

Permacel Tape Corp. has changed its name to *Permacel-Lepage's Inc.* The firm, a Johnson & Johnson company, acquired LePage's in 1956.

Main headquarters of Permacel-LePage's Inc. is located in New Brunswick, N. J .Other plant facilities are located in Gloucester, Mass., Toronto, Canada, Decatur, Ill., St. John's New Brunswick, St. John's, Newfoundland, and Pleasantville, N. J.

Archer-Daniels-Midland Opens New Office

Archer-Daniels-Midland Co. has opened a new branch sales office in Pittsburgh, Pa. *Charles A. Aldag*, formerly technical sales representative at Cincinnati, will manage the new office, located at Suite 308, 300 Mt. Lebanon Blvd., Pittsburgh 34.

Aldag joined the firm as a technical sales trainee in 1955, and was assigned to the Cincinnati office in 1956. A native of Indianapolis, he received a bachelor of science degree in chemistry from Purdue University in 1954 and a master of business administration degree from Indiana University in 1955.

Binks Appoints Fifield

The appointment of *Ralph Fifield* as manager of the Los Angeles branch of the *Binks Mfg. Co.*, Chicago, Ill., was recently announced.

Fifield, sales engineer in the San Francisco branch office since 1937, returned from military service in 1946 to be assigned to the Los Angeles branch as field representative responsible for sales contact and development in that area. His field experience and his familiarity with the needs of industry in the California market, coupled with his distribution knowledge especially fits him to this new post.

The Los Angeles Branch territory includes southern California, the entire state of Arizona, and the southern tip of Nevada.

Ralph Fifield

Oakite Appoints New Representatives

Oakite Products, Inc., manufacturers of industrial cleaning and metal treating compounds, have announced the

George D. Findlay, III

Donald R. Dutton

appointment of two new technical service representatives.

Donald R. Dutton, formerly a district sales manager for a large manufacturing firm, has been assigned to Lansing, Mich. *George D. Findlay, III*, for many years sales manager of a sporting goods firm, is the new representative in Vermont.

Both representatives recently completed an intensive eight-week training program at the company's New York laboratories and in the field.

Shell Opens New Terminal in Dallas

New facilities for the distribution of *Shell Chemical Corp.* industrial chemicals have been opened to serve the Dallas and Fort Worth areas. The terminal, located at 1309 Rock Island in Dallas, will permit delivery on short notice of glycerine in drums, Epon resins in drums and bags, and the complete line of solvents in tank trucks and drums.

The company's technical salesman, *O. D. Walraven*, will be located at the same address.

Dr. Francis L. Scott Joins Pennsalt

Dr. Francis Leslie Scott has been appointed to the post of project leader in *Pennsalt Chemicals Corp.'s* Technical Division.

He will conduct basic research in organic nitrogen chemistry to develop new and useful products derived from one of its basic chemicals, ammonia. A recognized authority in the field of nitrogen and sulfur chemistry, he is the author of more than 40 publications on the basis of which he is a candidate for the D.Sc., the highest

scientific award of the National University of Ireland.

Dr. Scott received his academic training at University College in Ireland. Upon receiving his Ph.D. degree in 1952, he became assistant professor and research director. He continued his post-doctoral research at UCLA where he was lecturer in organic chemistry.

His professional affiliations include the American Chemical Society, the Chemical Society of London, the Irish Chemical Society, the Royal Institute of Chemistry in England, and the Royal Netherland Chemical Society.

Michigan Chrome to Build New Quarters

Michigan Chrome and Chemical Co., announces the breaking of ground at the Grinnell Ave. plant in Detroit for a new 18,000 sq. ft. laboratory addition. The new quarters will provide laboratory facilities for both the Plating and Chemical Divisions of the company. Separate laboratories will be assigned to plating control, new products research, chemical products development, and technical service. Facilities will also be provided for a plating pilot plant, devoted to research and development of new plating techniques and processes; and a chemical pilot plant, which will assist in the commercialization of new developments in chemical research. The new building will also include an instrument laboratory, a library, a light equipment room, and a conference room.

The new building is scheduled for occupancy by March 1, 1958.

Bede Products Changes Corporate Name

To facilitate the transition into broader fields of manufacturing and marketing of their products, *U. S.*

Automatic Corp. has changed the name of its wholly owned subsidiary, *Bede Products Corporation* to *Nordson Corp.*, Amherst, Ohio.

Expanded manufacturing facilities will provide increased production of paint heaters and Nordson will continue to market the heaters under the original name and trademark. New district sales outlets will be announced shortly along with the opening of new branch offices and laboratories.

Nordson will operate as a wholly owned subsidiary of U. S. Automatic as it did prior to the change in corporate name. There is no intended change in personnel or operating policies and the company continues as the exclusive licensee under U. S. patents held by *James A. Bede* in the field of industrial finishing processes and equipment.

General Electric Appoints Robertson

Appointment of *James W. Robertson*, to the post of chemist in *General Electric Co.'s* New Product Development Laboratory, has been announced recently.

A native of Lynchburg, Va., Lt. Robertson received his B.S. degree in chemistry from Virginia Military Institute. He joined the firm in June, 1955, immediately after graduation, and was called to active service in the U. S. Air Force Reserves in November of the same year. He has spent the last two years at Wright Patterson Air Force Base in Dayton, where he was engaged in chemical development work.

Manufacturers' Literature

Organic Chemicals

Union Carbide Chemicals Co.

This 28-page booklet, F-6136, is a guide to the manufacturer's products and services. The latest physical property data is presented on more than 350 organic chemicals. An alphabetical index is included for the convenience of the user.

Fifty new chemicals introduced since the previous edition are featured. For easy reference, chemicals are arranged by related chemical groups with condensed application data.

128/Circle on Readers' Service Card

Abrasive Resistant Rubber

B. F. Goodrich Industrial Products Co.

A new catalog sheet describes how Armorite is used as a liner, curtain, throw mat or pad for protection against abrasives. The catalog sheet, in addition to outlining specifications, also features sections on how to install the material and how to choose the right thickness as conveyor skirting rubber.

129/Circle on Readers' Service Card

Coloring Epoxy Resin Compounds

Claremont Pigment Dispersion Corp.

Bulletin No. 290 on the PX series covers a complete range of color pastes for coloring epoxy resin compounds. For each color a code number is given, plus its name, pigment percent, weight per gallon, and price per pound.

130/Circle on Readers' Service Card

Brush Plating

Marlane Development Co.

"Practical Brush Plating With the Dalic Process" is the title of a new 12 page booklet, based on a paper by Marv Rubinstein. The booklet first explains the process, analyzes the metallurgical properties of the deposits, then devotes more than 8 pages to descriptions of typical time-saving engineering applications.

131/Circle on Readers' Service Card

Maintenance Units

Eclipse Air Brush Co.

This literature describes six complete maintenance units ready to paint from a unit ideal for touch-up and small jobs to a three man unit for maximum production from medium speed guns.

132/Circle on Readers' Service Card

Letter Filling

Logo Inc. Div., Bee Chem. Co.

A new leaflet describes various techniques used to fill recessed letters, symbols and numerals with paint. It describes problems involved with using coatings and dry wipes on second surface clear plastics, as well as machine applications and different types of masks that can be used. The bulletin should be of interest to design engineers, process engineers and finishing room supervisors.

136/Circle on Readers' Service Card

Surface Finish Instruments

Micrometrical Mfg. Co.

The new 14 page Profilometer catalog is illustrated with 37 halftone reproductions of the firm's line of instruments for measuring surface roughness.

137/Circle on Readers' Service Card

Blast Cleaning Hose Machines

Pangborn Corporation

A new 28-page reference bulletin No. 100C for the selection and application of hand operated blast cleaning machines used for maintenance cleaning, ornamental etching and carving, foundry operations, and exterior cleaning, describes fundamental methods of applying abrasives from hand operated nozzle blast cleaning units, as well as the applications of both wet and soft abrasives. A guide to correct hose machine selection is supplemented with a useful table showing how to match nozzle size with required abrasive size. Photographs, application data and operation techniques are given for all sizes of cleaning machines from small suction feed units to the large automatic machines.

Specifications of various blast cleaning accessories are included.

138/Circle on Readers' Service Card

Coated Fabric Gloves

The Granet Corp.

A new catalog describes in detail the industries and uses of six different lines of coated fabric work gloves, each designed for specific applications.

The realistic photographs and the physical property and chemical resistant charts help determine the best glove for specific applications.

139/Circle on Readers' Service Card

Stationary Air Compressors

Le Roi Division, Westinghouse Air Brake Co.

Three new pieces of literature describe the manufacturer's entire line of unit type and stationary air compressors. Features described in the two-color folders are lubrication systems, automatic protections, and volumes and pressures. Some specifications are also listed. Photographs and drawings are used in illustrating the products.

152/Circle on Readers' Service Card

Cost Reduction Through Dust Collection

Torit Mfg. Co.

This well-illustrated piece of literature explains the economies of dust control with unitized dust collectors through reduced capital expenditure, operating time and machine operating costs and an increase in employee efficiency.

On-the-job photographs and application stories are used to demonstrate typical installations of both cabinet cloth filter dust collectors and cyclone separator type collectors.

153/Circle on Readers' Service Card

Stainless Steel Finishing Methods

R. G. Haskins Co.

The above manufacturer of flexible shaft machines and accessory equipment recently issued its new 18 page catalog on stainless steel finishing operations. Of particular interest is the explanation of the requirements peculiar to stainless steel finishing and how they are best met.

The correct approach to actual finishing is presented in the order of the severity of the operations themselves. Thus, in this order, are grinding, sanding, the satin finishes obtained by using string wheels, polishing and buffing, along with detailed information on the techniques to be follow-

ed by operators, such as pressures, strokes, speeds, etc. An equipment section lists the recommended equipment for the above operations.

156/Circle on Readers' Service Card

Fluoride Salts

MacDermid Incorporated

The use of dry fluoride bearing salts, Metex Etch Salts, to replace liquid hydrofluoric acid in metal finishing treatments, is fully described in Technical Data Sheet #50, a two-page usage and instruction sheet.

157/Circle on Readers' Service Card

Drain Pipe

Logan Clay Products Co.

A new four-page circular illustrates and describes installation features and specifications of Chemi-Drain channel pipe, a chemically-inert vitrified clay product for the handling and disposal of highly-corrosive fluid industrial wastes.

158/Circle on Readers' Service Card

News from California

By Fred A. Herr

Meyer Roter and *James Berker*, owners of Artcraft Plating & Finishing Co., 2532 Hollywood Way, Burbank, Calif., have completed a further expansion of their facilities by the addition of a separate printed circuitry department and enlargement of the plating on magnesium division.

The new circuitry department occupies a 50 x 100 foot section of the company's plant, for which purpose floor area was withdrawn from the paint department. Major equipment consists of photo etching apparatus, flushing machines and several etching units for production circuitry work.

Don Baudraud, a partner with the late *Delos D. Eldred* in the Eldred Laboratories, Los Angeles, reports that he is in process of reactivating the laboratory facilities at 791 E. 15th St. under his own management and ownership.

Baudraud has acquired from Mrs. Eldred her late husband's interest and plans to expand the existing laboratory to include service for making plating solution analyses, thickness and corrosion tests, and salt spray tests, under a government Air Force certificate. Mr. Eldred died March 22, 1957, after a year's illness from heart trouble.

Paul Franke, plating shop foreman for the Price-Pfister Company of Los Angeles, reports some unusual experiences on a recent vacation trip he took to Yosemite Valley with Mrs. Franke.

First, an 800 pound black bear invaded their cabin in Yosemite one night while the Frankes were in bed, and, to their amazement, grabbed a

rug with his teeth and disappeared with it into the night.

On the way home, Paul related, their car ran over a six-foot rattlesnake which was slithering across the road in Fish Canyon along which they were driving. Paul wasn't positive the rattler was killed but did not stop to investigate. Under California law, any motorist who drives over a rattler must stop at the nearest garage or service station to have his tires washed — to remove any fangs or poison that may have adhered to the tire and which might be injurious to some other service station man later on.

A talk on the pure physics of color as well as the psychophysics of color, by *R. L. Lynch* of the R.B.N. Dispersions Co., featured the educational program of the October monthly meeting of the Los Angeles Paint & Varnish Production Club, which was attended by 155 members and guests.

Mr. Lynch first presented a color film on the physical aspects of color, "This is Color", which reviewed the physics of color with well illustrated examples of the aspects of color.

The membership was asked by the chair to propose outstanding individuals in the industry for selection to the Federation Hall of Fame, which were to be sent to *Everet J. Cole* of the New York Paint & Varnish Production Club for evaluation.

The Los Angeles Club presented *Dr. L. Reed Brantley* of Occidental College, Los Angeles with a check to continue the *E. Robert Hollinger* Fellowship during the coming year on adhesion studies. Introduced to the membership was *Miss Marilyn Eakin*, a former Occidental student and one of the first recipients of the Club-sponsored fellowship. Miss Eakin, it was announced, is now an employee of the U. S. Chemical Milling Co.

Francis T. Greenup has been appointed chief product engineer for Consolidated Electrodynamics Corp., Pasadena, Calif. Greenup succeeded *A. F. DuFresne*, who has been transferred to the firm's new Analytical and Control Instruments Division. Greenup joined the company in the capacity of a design engineer in 1955 and, since February, 1957 has served as assistant chief product engineer.

A fifteen acre site has reportedly been acquired in the Keith Shaffer Industrial Park area of Santa Cruze County, Calif., as the site for a proposed new factory and warehouse for the Bay State Abrasive Products Co. of Westboro, Mass. The date when construction on the newest coast plant will begin has not yet been announced. The project is part of the company's two million dollar expansion program which was announced two years ago.

Charles W. Cochran recently was appointed operations manager in charge of production of the Fullerton, Calif., plant of the Rheem Automotive Mfg. Co. Cochran began with the organization as a design engineer in the Edystone, Pa., plant in 1946; and has also served as plant manager of the ordnance plant in San Pablo, Calif., and in the same capacity in the Burlington, N. J. plant.

OBITUARIES

MRS. T. A. TRUMBOUR

The many friends of *Thomas A. Trumbour,* general manager of *Metal Finishing,* will be saddened by the recent death of his wife *Elizabeth.*

Mrs. Trumbour passed away November 12, 1957 in Hawthorne, N. J., where the family has resided since 1923. The deceased was a member of St. Anthony R. C. Church in Hawthorne, the Rosary Society of the parish. and the Ladies' Catholic Benevolent Association, Butler Council. A High Requiem Mass was celebrated in St. Anthony R. C. Church of Butler, N. J., where Mr. and Mrs. Trumbour were married in 1904. Interment was made in Mt. Calvary Cemetery in Butler.

Surviving, in addition to her husband, are two sons, *Thomas H.* and *John E.* of Hawthorne; four daughters: *Mrs. Jack (Frances) Drennan, Mrs. Elizabeth Meyers, Mrs. John (Dorothy) Tschopp,* all of Hawthorne, and *Mrs. William (Joan) Wiarda* of Chicago, Ill.; one sister, *Mrs. Edith Pellington* of Hartford, Conn.; 16 grandchildren; eight great-grandchildren.

RAY PARKER

Ray Parker, only recently appointed as Eastern Michigan representative for *American Buff Co.,* Chicago, died Sunday, October 13, after a heart attack. His untimely death closed a life brimming with activity and interest in both the metal finishing industry and leisure sports. A member of the Birch Park Hunt Club, V.F.W., and the American Electroplaters Society, he was also a licensed pilot, sports car driver and racer, swimmer, water-skier and rider. His business rise, starting with work on the wheel, took him up through shop supervision to specialization in stainless steel metal finishing and consulting engineer in this field. Then his natural sales ability turned him to selling metal finishing supplies, and, in 1956, to American Buff Co. He is survived by his wife, Julia, and two children.

DR. PAUL DYER MERICA

Dr. Paul Dyer Merica, who retired as president of *The International Nickel Co. of Canada, Ltd.,* in April 1954, but continued to serve the company on important projects and as consultant to the officers, died on Sunday evening, October 20, at the Phelps Memorial Hospital in Tarrytown, New York, where he had been taken following a heart attack at his home in nearby Millwood, New York, on Friday evening, October 18. He was 68.

Dr. Merica was a director of the company and its United States subsidiary, *The International Nickel Co., Inc.,* and of *American Metal Company, Ltd., Babcock & Wilcox Co.* and *Whitehead Metal Products Co., Inc.*

CHARLES W. YERGER

Charles W. Yerger, 72, former executive vice president of *Hanson-Van Winkle-Munning Co.,* Matawan, N. J., died Sunday, Oct. 13, 1957 in Tucson, Ariz.

Mr. Yerger had resided in Matawan from 1928 until 1946 when he became chairman of the board of the *Lea Manufacturing Co.,* Waterbury, Conn. He was active in community affairs and served for five consecutive terms as president of the Matawan Township Board of Education. He was a former president of the Matawan Civic Club.

After leaving Matawan, Mr. and Mrs. Yerger resided for some time in Connecticut.

INDEX TO VOLUME 55 — METAL FINISHING

JANUARY-DECEMBER, 1957

(Compiled by N. Hall, Technical Editor, and I. Oquendo, Assistant Editor)

In this index all material that appeared in the January through December 1957 issues of *Metal Finishing* is listed according to subject matter, with cross references where required. Although *Organic Finishing* magazine was merged with Metal Finishing effective with the November issue, all subject matter pertaining to this field will be found in the Organic Finishing index which follows. Following each listing will be found a letter indicating the manner in which the material was published, as follows:

(S)—Shop Problem
(R)—Recent Development
(P)—Patent
(M)—Manufacturers' Literature
(B)—Book
(L)—Letters to the Editor
(A)—Abstracts from Foreign Literature

Any reference not followed by a letter was a feature article. The numbers in the right-hand column refer to the month and page numbers; **6**-85 means June issue, page 85, etc.

INDEX TO AUTHORS

INDEX TO VOLUME 18 — ORGANIC FINISHING - 1957

(Compiled by Daniel A. Marino, Assistant Technical Editor, and Inez Oquendo, Assistant Editor)

In this index all material that appeared in the January through October 1957 issues of *Organic Finishing* is listed according to subject matter, with cross references where required. In addition, subject matter dealing with paint finishing which appeared in the November and December issues of *Metal Finishing* is included. Wherever a page reference is preceded by 11 or 12, it refers to issues of *Metal Finishing*. Following each listing will be found a letter indicating the manner in which the material was published, as follows:

(A)—Abstract of Foreign Literature
(E)—Editorial
(M)—Manufacturers' Literature
(P)—Patent
(R)—Recent Development
(S)—Shop Problem
(B)—Book

Any listing not followed by a code letter was a feature article. The numbers in the right-hand column refer to the month and page numbers. For example, **6-25** means the June issue, page 25, etc.

INDEX TO AUTHORS

SITUATIONS OPEN

SITUATIONS WANTED

ELECTROPLATING ENGINEER

SITUATION WANTED—Electroplating engineer with diversified background in process metallurgy. Plating experience in brass, cadmium, chrome, copper, nickel, silver, gold, palladium and rhodium for decorative and industrial uses. Capable of laboratory controls, heat treating and metallography. Interests in technical sales or industry. Address: October 3, care Metal Finishing, 381 Broadway, Westwood, N. J.

ELECTROPLATING SUPT. OR MANAGER

SITUATION WANTED—Have 25 years of experience in all types of electroplating and anodizing. Can make up and maintain solutions; also full knowledge of buffing, metal spraying, soft soldering and white metal casting. Have been in supervisory capacity for past 15 years. Adddress: October 4, care Metal Finishing, 381 Broadway, Westwood, N. J.

PLATING EXECUTIVE

SITUATION WANTED—I have experience in all types of decorative plating — cadmium, heavy silver, hard chrome; also phosphatizing, electropolishing of stainless steel, and anodizing. Have also had as many as forty men and women under my supervision. Address: November 3, care Metal Finishing, 381 Broadway, Westwood, N. J.

FINISHING MANAGER

SITUATION WANTED—Management position wanted by high caliber man in manufacturing plant or large job shop. Prefer midwest location. Completely experienced to handle personnel, union relations, solutions and equipment. Salary plus bonus in the $15,000 range. Resume upon request. All replies answered. Address: December 3, care Metal Finishing, 381 Broadway, Westwood, N. J.

PLANT MANAGER

SITUATION WANTED — Seventeen years experience. Analyze and control all solutions; fully capable in barrel, still or automatic operations and have developed several plating methods, including barrel chrome. Have also supervised up to 60 in polishing, plating and lacquering and built several plants, one a full automatic. Address: November 2, care Metal Finishing, 381 Broadway, Westwood, N. J.

FOREMAN PLATER

SITUATION WANTED (In Florida area only)—Twenty-five years experience in copper, nickel, chromium, silver, brass, cadmium-zinc, phosphate coatings. Barrel and still tank operation; polishing, buffing and job or production work. Forty years old, married 17 years, have 3 children. Address: December 4, care Metal Finishing, 381 Broadway, Westwood, N. J.

READY-REFERENCE SECTION

—USED EQUIPMENT AND SUPPLIES—

ADVERTISING RATES
Per column inch per insertion

1 time	$10.00
3 times	9.00
6 times	8.50
Yearly (12 times)	8.00

READY-REFERENCE SECTION
—USED EQUIPMENT AND SUPPLIES—

ELECTROPLATING
POLISHING
RUST PROOFING
CLEANING
ANODIC TREATMENT
ETC.

PRICED RIGHT FOR QUICK SALE

1—Rampe Shaker.
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1500/750	6/12	Chandeysson
1500	15	Star
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1500	40/65	G. E.
1500	65	Westinghouse
1500	70	Century
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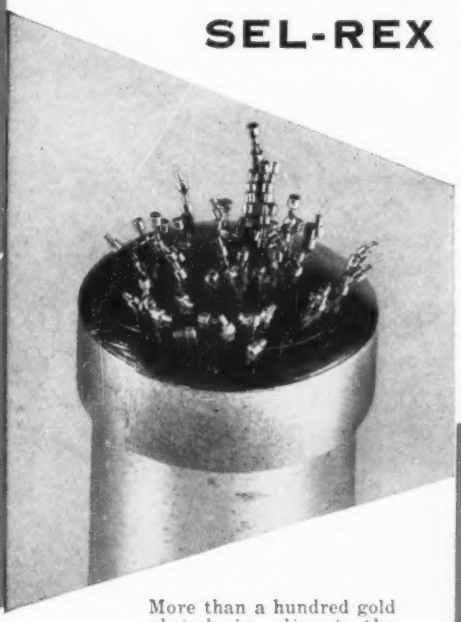

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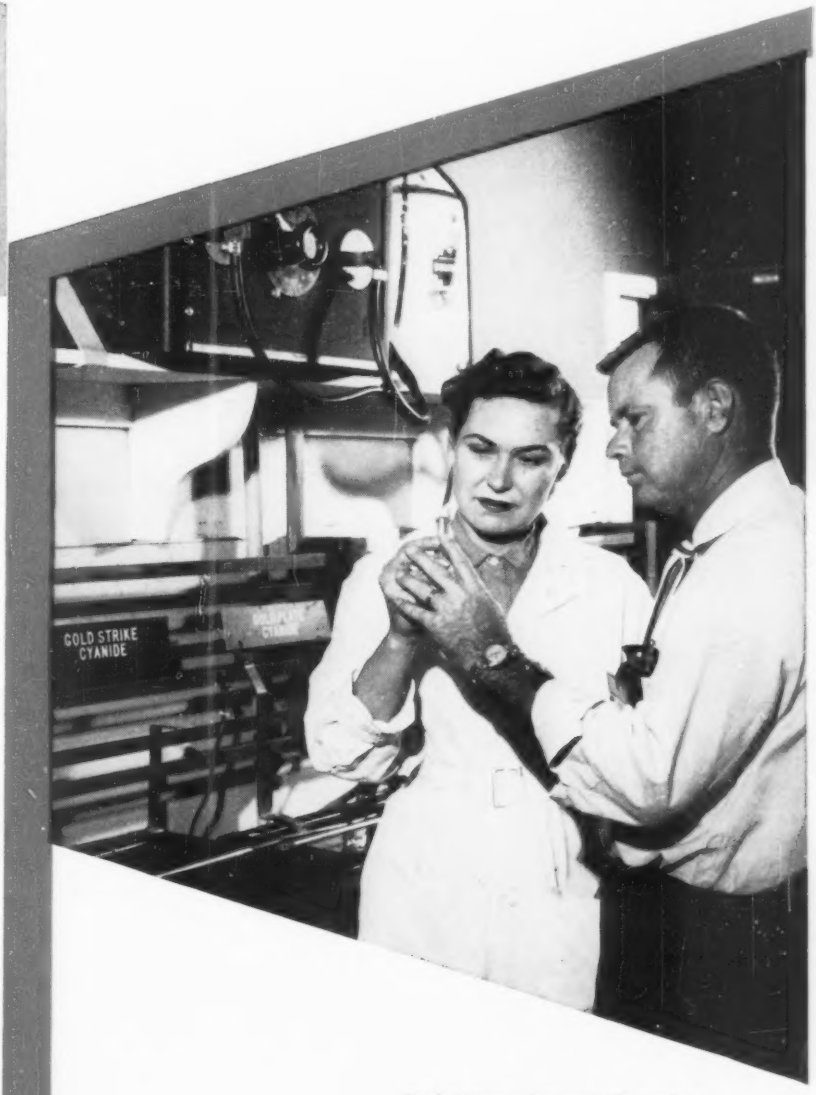

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